Volume V

TRANSCRIPT OF RECORD

SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, 1963

No. 204

UNITED STATES, APPELLANT,

vs.

ALUMINUM COMPANY OF AMERICA, ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF NEW YORK

FILED JUNE 11, 1963

PROBABLE JURISDICTION NOTED OCTOBER 14, 1963

SUPREME COURT OF THE UNITED STATES

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[fol. 5789] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 387

Exhibits in Reynolds Metals Company depositions of John H. Krey, W. M. Franklin, Robert L. Teeter, Allyn Dillard.

March 29, 1961.

[fol. 5790] Confidential

January 28, 1959

Minutes of Insulated Wire and Cable Discussion

Copy sent to John Krey, February 2, 1959

Present: Messrs. W. M. Franklin, H. A. Adams, J. C. Warford, R. L. Teeter.

The Reynolds Metals Company has been meeting increasing objections from its customers, particularly its distributors, regarding the incompleteness of its line of wire and cable products. Since Alcoa's acquisition of Rome Cable Co. last week now leaves Reynolds as the only major aluminum or copper company without insulating facilities, it is expected that our sale of metal to electrical applications will suffer materially if some action is not take to enlarge our wire and cable product line.

It was recognized that our recent acquisition of the British aluminum stock, prohibited any early acquisition of a wire and cable company. This meeting was, therefore, called to consider what other alternatives might be available.

Messrs. Franklin, Adams and Warford felt that installation of our own compounding stranding, and installation facilities would be the next best alternative to acquisition. Pending detailed study of exact product line requirements and necessary facilities additions, it was expected that at least 2 to 3 million dollars immediate investment would be required.

Mr. Teeter did not agree that installation of our own facilities was the best alternative. He pointed out that establishment of the necessary reputation for quality and knowhow in insulated products manufacture would take at least several years. In addition he questioned the availability at this time of the necessary 2 or 3 million dollars, particularly in view of the fact that a satisfactory return on investment could not be conservatively claimed for a period of several years after the installation. Finally, all agreed that the ability to offer copper products, where superior, was very desirable. Installation of our own facilities would permit this to only a limited extent.

All agreed that if funds were not available either for acquisition or for installation of our own facilities, a satisfactory temporary solution might be a team or joint merchandising arrangement with one of the better remaining independent insulated wire and cable manufacturers. For example, we could arrange to merchandise some of their items under the Reynolds' insignia, recognizing the source if desirable, and they could merchandise our wire and cable products similarly if they so desired. The following possibilities were discussed:

1. *John A. Roebling (Subsidiary of Colorado Fuel & Iron Co.)* This company has a national reputation for competitive quality, and a product line containing predominately those items subject to early penetration by aluminum, such as power cables, magnet wire, building wire, etc.: They do not manufacture ACSR and [fol. 5791] related products, thus a team merchandising arrangement would permit them to augment their own product line to their benefit as well as to ours.

   In addition, whereas we now buy the steel core wire for our ACSR from Detroit Steel, Roebling also offers this material and might in this manner be able to obtain our account.
2. *Simplex Wire & Cable Co.* It was doubted if any partnership arrangement would be of interest to them. Although their facilities are suitable, they do not currently manufacture building wire, service entrance cable, overhead transmission cable, or magnet wire; all of which would be of interest to us.
3. *Essex Wire Corp.* These people have previously indicated an interest in working with us in connection with a molten metal arrangement, but their line and reputation for quality are not as suitable for a team operation as the preceding companies.
4. *Triangle Conduit & Cable Corp.* Messrs. Adams, Franklin and Warford felt that this company was the least attractive of the four major independents for a team arrangement. In particular, its line does not include the heavier industrial cables of most interest to us.
5. *General Cable Co.* Too large to be interested.

6. *General Electric Co.* Except for the complicating legal problems raised, G.E.'s product line would fit nicely in with our own, and they could benefit from the addition of our line.

In addition to the above noted U.S. companies, Mr. Teeter advised the group of the existence of a partnership between Canadian British Aluminum and the Phillips Electrical Co. Ltd. in Canada called Phillips-CBA Conductors, Ltd., for the production of wire and cable products. Additional information is to be obtained about this relationship to see if our product line could be usefully supplemented by arrangement with Phillips-CBA Conductors.

The above possibilities are to be discussed with our respective managements, to be pursued as they indicate.

Robert L. Teeter.

RLT/rk

cc: Messrs. W. M. Wells, C. A. Wishart, I. Roberts (2), W. M. Franklin (2), H. A. Adams, J. C. Warford, R. L. Teeter.

[fol. 5792] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 388

A Plan for the Joint Promotion of Copper and Aluminum in the Electrical Market By Phelps Dodge and Reynolds

Introduction

In view of the large price differential favoring aluminum over copper in the electrical field it is inevitable that we shall see a continuing substitution take place as technological improvements are made in overcoming aluminum's inherent mechanical disadvantages. First there was the overhead transmission cable, then the overhead distribution cables and the service drop cables and now the aluminum companies are organizing to go after the insulated cables.

Kaiser took over the U. S. Rubber Company's wire and cable division and launched a vigorous campaign to pro-

mote aluminum building wire and power cable but being the only company really pushing these products they have not made too much progress.

Alcoa bought the Rome Cable Company and have put in one of their own men as Vice President and General Sales Manager and we can expect that they will now aggressively push aluminum insulated cables along with Kaiser. Progress in the utility field can be expected as they are greatly concerned about rising costs and the stepping up of the public power competition. In the industrial and construction fields the price difference cannot help but bring about a greater use as soon as methods are found and publicized for overcoming the troubles with connectors and joints.

The next move was when Reynolds told us in June that they were going to go aggressively after the electrical market in which they had not been much of a factor. They intend to do one of three things—build a completely new facility estimated at around $30,000,000, purchase an existing company and enlarge it, or work out a deal with us to jointly promote both copper and aluminum in the electrical market. [fol. 5793] At the meeting held on June 17th between officials of Phelps Dodge and Reynolds, it was agreed that there was a sufficient common interest to justify having a joint task force prepare a plan whereby the two companies could cooperate in the sale of aluminum and copper in the electrical market, it being the feeling that the total volume of sales would be greater if the two companies acted together than if each went its own way.

Plan I developed by the task force called for a joint sales company equally owned which would sell the products manufactured by each of the parent companies. Reynolds rejected this because they did not think the sales company would have enough substance binding the two parties together with the result that it could come apart too easily.

Plan 2 was primarily Reynolds thinking and called for the joint company to lease the cable-making facilities of Habirshaw and their cable mill at Listerhill, Alabama. We were not enthusiastic about this because the leasing arrangements would be very complicated and they would have equal control of the company of which 80% of the sales force would be our people and the volume of copper products would be almost three times that of the aluminum products.

We have now come up with Plan 3 which so far has only been roughly outlined to Reynolds.

Basically, the plan calls for the formation of two companies, a manufacturing company to be equally owned and a sales company to be owned two-thirds by Phelps Dodge and one-third by Reynolds.

The manufacturing company would be known as "Phelps Dodge Reynolds Wire and Cable Corporation" and it is proposed that it be located in the south or middle west. [fol. 5794] One possible location would be the U. S. Rubber Company's plant adjacent to our Inca plant. This would have the advantage of enabling the company to get into production a year earlier than if a new facility were built and in view of the proximity of I. R. & W. would eliminate the necessity of having any copper wire drawing or stranding equipment in case it was necessary to fill out the manufacturing at times with copper products as these products could be obtained from our I. R. & W. plant.

The plant is more than adequate for the proposed operations, comprising 568,000 square feet on 60 acres of land. There would be ample space for the proposed operation, including space for a rod mill, casting shop, and a reasonable amount of room for further expansion and storage.

This plant would be on the lines of the American Electric Power Corporation which is a large user of aluminum transmission cable but unfortunately also has Anaconda, Essex and Kaiser on their lines. Ormet is also a large customer of theirs so any cable company using their aluminum would have a reciprocal position, therefore, consideration should be given to locating the plant on the lines of a utility system that could do more for us such as the Southern Company or Texas Utilities.

The plant would have the most efficient possible setup for the manufacture of aluminum cables in view of the very competitive nature of this market. This would involve a new rod mill particularly as Reynolds does not have a rod mill at present. It produces its rods by slitting heavy sheet.

Reynolds would contribute the wire and cable equipment [fol. 5795] now at its Listerhill plant on a depreciated value basis, and would discontinue that mill.

An estimate of the capital needed for the manufacturing company is $20,100,000 made up as follows:

Purchase price of U.S. Rubber plant	$ 4,000,000
Alterations of building	400,000
Equipment	5,200,000
Installation cost	1,200,000
Rod mill, including installation	2,000,000
Casting facilities	500,000
Pre-operating expenses	700,000
Engineering	700,000
	14,700,000
Contingencies (10%)	1,500,000
	16,200,000
Inventory of lifo aluminum and other materials	2,400,000
Other working capital	1,500,000
	$20,100,000

The above estimated equipment costs are based on new equipment and do not take into consideration the equipment to be furnished by Listerhill. The cost of the new equipment included in the above estimate corresponding to the Listerhill equipment is $2,600,000.

The proposed initial capacity of this plant, based upon the estimated business the sales company could obtain in 1960 would be approximately:

ACSR transmission cable	$15,000,000
All-aluminum bare cables	2,000,000
Aluminum bare and covered line wire	3,000,000
Aluminum service cable	1,500,000
Aluminum building wire and power cable	3,500,000
Total	$25,000,000

This would require approximately 50,000,000 pounds of aluminum per year although initially, at least, a part of the building wire production might be made with copper conductors.

[fol. 5796] The estimates are based on the following operating rates:

	1960	1965
Drawing	1 shift	3 shifts
Stranding	1½ shifts	3 shifts
Cabling	1½ shifts	3 shifts
Extruding	One or more shifts, depending upon the insulating volume of the various compounds.	

The above tabulation might seem to be out of balance for a five-year growth, but it is necessary to have a large initial investment in machinery, especially in ACSR, in order to obtain the required percentage of the immediate market.

Reynolds have indicated that at the present time they are doing $12,000,000 a year of ACSR transmission cable, all aluminum bare cables and line wire. They estimate that by 1960 the total market for these products will be 300,000,000 pounds or about $150,000,000, therefore, our sales of $20,000,000 would only be about 13% of the market.

Aluminum has replaced copper to a large extent in the service cable market and we believe the joint company can reach the $1,500,000 sales figure in 1960.

In our opinion the $3,500,000 figure for aluminum building wire and power cable for 1960 is on the high side but Reynolds are convinced that this market is going to develop rapidly and that by then we should be able to reach this amount.

Nema statistics unfortunately do not help us too much in forming our opinion on this as there are companies who are important in this field which do not report to Nema. Nema's aluminum sales only show $2,000,000 for the first six months of 1959.

The sales company is outlined in the attached memorandum.

[fol. 5797] It is recommended that we submit Plan 3 to Reynolds for their consideration making it clear that it is submitted for discussion purposes of the task force and has not yet been fully approved by Phelps Dodge, although we do consider it as a definite possible method of operating. If this plan should eventually be approved it would be our suggestion to proceed immediately with the formation of the sales company and agree to go ahead with the manufacturing company but consideration should be given to the fact that the prices for aluminum wire and cable at the present time are so low that the manufacturing company could not possibly show a profit using the market price of aluminum ingots. In fact some items are so low that the aluminum would have to be put in at no cost, therefore, the joint manufacturing company's new facility should be postponed until there are signs of better prices or some way is found whereby Reynolds can underwrite this loss the same as Kaiser and Alcoa must be doing for their fabricating subsidiary.

[fol. 5798] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 392

John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation
640 South Broad Street, Trenton 2, New Jersey

William C. Ridge
Executive Vice President

February 1, 1961.

Mr. John H. Krey, Vice President
Reynolds Metals Company
6601 Broad Street Road
Richmond, Virginia

Dear Mr. Krey:

The following will confirm our recent discussion. Our Board of Directors has decided to liquidate a portion of our Electrical Wire Division and we are now in the process of accomplishing the project. In this connection we wish to sell, as is, where is, certain machinery and equipment used in the manufacture and testing of electrical wire and cable, and located in our Buckthorn Plant, Trenton, N. J., and our Copper Wire Mill, Roebling, N. J. Excluded from the sale would be:

(1) The equipment used for cleaning and bundling copper rods, and for electrolytic copper recovery and overhead tramrail system, all located in the Copper Wire Mill.

(2) Equipment which is properly considered a part of the real estate or facilitates its operation and sale, such as the equipment contained in the boiler house, the electrical distribution system, yard railroad tracks, fire protection equipment, overhead cranes, incinerators, elevators, docks, radio and transportation equipment used by plant guards, yard railroad tracks.

(3) Office furniture and equipment, time clocks, certain industrial lift trucks,

We are prepared to sell this machinery and equipment at a price of one million dollars ($1,000,000). Any such sale would, of course, be subject to our mutual agreement on a list of items of machinery and equipment to be sold, arrangements for the removal and reconditioning of buildings after removal and detailed terms and conditions of sale.

Very truly yours, William C. Ridge, Executive Vice President.

W.C.Ridge:EPG

[fol. 5799] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 393

March 1, 1961.

Mr. William C. Ridge
Executive Vice President
John A. Roebling's Sons
640 S. Broad Street
Trenton 2, New Jersey

Dear Mr. Ridge:

This will reply to your letter of February 1, 1961.

Since your letter was received there have been, as you know, further discussions about the exclusions which you mentioned, and there are to be certain changes in the items which you listed. I believe it is now understood also that there is not to be any arrangement for reconditioning of buildings. Subject to these qualifications, your letter in general is in accordance with our understanding.

As you know, the inventory of equipment has not been completed. In order to clarify further our understanding of the items which are to be included in the sale I have asked Mr. Hedgecock to indicate in a general way the items which he understands are to be included. The list which he has prepared is enclosed.

Sincerely yours, John H. Krey, Vice President.

GBM:mf
Enclosures

[fol. 5800] Items to Be Included in Sale

Copper Mill

This includes all of the production equipment in this building and its accessory items. This primarily consists of the complete tin plating lines, stranding equipment, marking and forming machines, wire drawing equipment including solution pumps, tanks, furnaces complete with atmosphere converter and controls, wire shaving equipment, turkhead and flattening equipment, bunching and spooling equipment, portable and floor scales, specialized handling equipment including industrial trucks, both rider and hand operated, battery charging equipment and batteries, complete die room equipment including all dies, equipment spare parts including motors and controls, wood and steel pallets and wood and steel reels, D. C. rectification equipment, including transformer, small maintenance shop and portable equipment, overhead tramrail and handling equipment serving production machinery including grabs, skids, all butt welders and brazing equipment, miscellaneous wire balers, wrapping machines, all motors and control equipment serving production units, tensile and electric test room equipment, operating data and instructions and records, including equipment drawings.

This excludes office equipment, rod cleaning system and tanks, copper recovery system, tramrail and other handling equipment over this area, workmen's locker facilities, general lighting, air and water piping.

The above basically includes all of the production and associated equipment listed in the copper mill asset records dated January 1, 1961 as Report No. 999, with the above listed exclusions. Not listed in this asset record but included in this transfer are miscellaneous supplies and equipment concerned with the production equipment and operations.

Buckthorn Plant

This includes all of the production equipment in this plant, as well as its accessory equipment. It also includes all operating data and instructions and records, including equipment drawings.

All maintenance shop equipment including maintenance

and production equipment and spare parts and hand tools and miscellaneous maintenance equipment for electrical, riggers, millwrights and other trades, box shop equipment, [fol. 5801] pipefitters shop equipment including hand tools and miscellaneous pipefitting maintenance equipment, air compressors and accessories, floor maintenance equipment, platform and floor scales, all laboratory and production testing equipment and accessories, development laboratory equipment associated with power cable.

All salvage center (stripping shed) equipment, all portable and floor scales. All industrial trucks including batteries and charging equipment. All general type material handling equipment including grabs, slings, etc. All D. C. generating equipment for production machinery and testing, all rubber mill equipment including Banbury mixer, conveyors, mills, calenders, tubers, slitters, boxes, bins, braiders, all patching equipment, continuous vulcanizing machines, cabling equipment, electrical test equipment, saturators, lead extruder equipment, lead strippers, strip covering machines, taping machines, test sparkers, service entrance machinery, spoolers, universal winders, presaturating equipment, Dialec wrappers, spiral marking striping, printing and polishing,equipment, coilers, plastic extruders, testing and reel equipment, all tool room equipment and tools, vulcanizing equipment (dome and horizontal), rubber filling machinery, ventilating equipment, lacquering equipment, all winding machines, large and small coilers and other shipment preparation equipment, paper insulating and belting equipment, varnished cambric insulating equipment, taping equipment, all spooling and rewinding equipment, armoring equipment, curing tube equipment, horizontal and vertical impregnating tanks, pumps, oil purification systems and associated equipment, lead presses, lead melting pots, control pumps, all tools and dies for all equipment, all film covering (enamel wire) equipment, controls, rewinders and associated equipment, including weighing, wrapping and packing units, all fibrous covering (magnet) wire insulating and rewinding equipment.

The above includes all spare equipment parts, tools, dies, reels, spools, pallets and accessories for the production equipment. It is also assumed that the equipment attached to and part of the basic production equipment is included,

making each piece of equipment a complete operating machine.

The above basically includes all of the production and associated equipment listed in the Buckthorn Plant asset records dated January 1, 1961, as Report No. 999. Not included in this report but included in this transfer are miscellaneous supplies and equipment concerned with production equipment and operations.

[fol. 5802] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 396

Transmittal Memo
R-673-1 (Rev. 1-60)

Date......................................
To...................................... At......................................

☐ Per Your Request
☐ Read and Pass On
☐ Note and Return to Me
☐ Note and Retain for Your Files
☐ Handle with Sender
☐ Prepare Reply for My Signature
☐ Take Appropriate Action
☐ For Your Information
☐ Signature

Remarks:

Mr. D. P. Reynolds' secretary, Beatrice Adkins, has made a thorough search in the files in his office but cannot find the original of this letter.

From......................................
At......................................

[fol. 5803]

October 4, 1957.

Mr. D. P. Reynolds
General Sales Office

Dear Dave:

Subject: Insulated Wire and Cable Program

One of the most important projects we have before us at present is firming up a program on increasing the supply of aluminum to the electrical industry.

Walter Franklin, Dr. Irving Roberts, and others are presently investigating companies in the insulated wire and cable field with regard to their line of products, the physical making of equipment, and evaluation of products most adaptable to conversion to aluminum.

My feeling at this time is that the die is cast on direction we should take. Our principal competitors in primary production are committed to integrated supply of these products. General Cable will be affiliated with Olin-Revere Reduction Company. Kaiser has purchased U.S. Rubber, and I believe will acquire others. Anaconda has the Anaconda Wire and Cable Company.

To properly introduce and merchandise insulated wire and cable products, you must be in a position to have product control. Also important is a complete line of products to become a factor with the supply houses or distributors. They will want to associate themselves with a company with an integrated and complete line.

My purpose in this letter is to emphasize these points and ask that you personally review this subject with the group involved as soon as they complete their reports and have recommendations.

With best regards, J. M. Stuart.

JMS:dd

Copies: W. T. Ingram, K. E. Hall, W. Franklin, Dr. I. Roberts—Richmond

October 7, 1957.

[fol. 5804] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 398

Memorandum from
Corporate Finance Department

June 4, 1958.

To: W. C. Huebner
From: J. M. Rae
Subject: MEFA-8285

On Tuesday, May 27, 1958, I talked with the following people in Philadelphia regarding the company in Conshohocken, Pa.

Mr. William B. Walker, Executive Vice President
The First Pennsylvania Banking and Trust Company
Mr. Garner O. Fletcher, Sr. Trust Investment Officer
Girard Trust Corn Exchange Bank
Mr. John H. Rypass, Partner
E. W. Clark & Co. (Investment Bankers)
Mr. Shaler Stidham, Vice President
The Philadelphia National Bank

and in Conshohocken, Pa:

Mr. Donald P. Horsey, Vice President
The Philadelphia National Bank (Branch Manager)

Principal bank of account is the Philadelphia National Bank. It came to them through the bank in Conshohocken which they bought and now operate as a branch. The company has done business there for many years.

The senior management are men of long residence in Conshohocken, active in community affairs, the Presbyterian Church, and are very highly regarded. Opinion is that they are the type who would get along well with other management people.

They have been approached a number of times recently by people seeking to purchase or acquire this company by one means or another. The answer to such proposals has so far been a definite No! That does not mean, however, that an approach by our client would be rebuffed. One of the

officers at Girard Trust has a good entre through the Company's auditors through which he can ascertain the owner's true attitude regarding acquisition under the general conditions our client proposes. He will do so and write us the information he obtains. (Note: we asked this officer to refrain from any follow up).

All of the stock is held by Mr. H. S. Walker, the Chairman, and his family, and the family of his brother who died not long ago. Mr. Hervey J. Walker is 79 and certainly should understand and appreciate matters of estate taxes and capital gains taxes. He is the power in this company, very able, and has actually been the active operating management head for many years.

[fol. 5805] A. M. Callanan, Vice President, is the second man on the senior management team. He has always been and still is the principal marketing man for the organization. I am told he is a very able man, but he also is about 70 years old.

The third man on their senior management team is A. T. Cameron, Executive Vice President. He is the financial man, and an excellent one. Again, however, he is about 70.

Presumably, these three senior officers are about ready to retire. To take their places, I am informed that the company has a solid and progressive successor management team to take over. They also, I understand, are people who would fit in well for the kind of relationship our client seeks.

I am told the company has excellent products used for electrical transmission and distribution, both aluminum and copper cable of best modern type, also steel conduit products, and similar items. They have a nation-wide market which they serve through independent distributors. The distributor organization is said to be a very good one. Sales have shown very substantial growth in recent years, and they have more than kept up with the industry. Sales in 1957 were about $21 million, I understand, and profit margins are very satisfactory, but I couldn't get the exact figures.

The plant, I understand, is in excellent condition and much of the equipment is new. Manufacturing is said to be excellent. They have above average production management, thoroughly competent labor, and good labor relations. Products are well engineered and the company is alert in research

for new developments. A new product for which sales have been substantial and growing is known as the "underflooring" line.

Financially, the banks regard this company a strong and a very high credit risk. They believe it to be thoroughly sound in this regard, with excellent financial management. I was told they have a revolving credit line of $2,000,000 and currently borrowing about $1,000,000 from the principal bank.

In brief, this seems to be an excellent company in every respect.

In regard to Crescent Insulated Wire & Cable Co. (Inc.) in Trenton, I was unable to obtain information from Philadelphia banks other than that they do its banking with the Trenton Trust Company (known as Mrs. Roebling's Bank).

ah

[fol. 5806] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 399

June 27, 1958.

Mr. John E. Toulmin
Senior Vice President
The First National Bank of Boston
Boston 6, Massachusetts

Dear Mr. Toulmin:

Thank you very much for your letter of June 26. I appreciate very much your interest and time spent on our behalf. While we are naturally disappointed to have the "door closed" it certainly saves us any unnecessary time and expense of further investigation.

Sincerely yours, Walter C. Huebner, Assistant Manager.

WCH:ah

[fol. 5807] THE FIRST NATIONAL BANK OF BOSTON

Boston 6, Massachusetts

John E. Toulmin
Senior Vice President

June 26, 1958.

Mr. Walter C. Huebner
Ebasco Services Incorporated
Two Rector Street
New York 6, New York

Dear Mr. Huebner:

I had an opportunity yesterday to spend a hour or more with Everett Morss, President of Simplex Wire & Cable Company. While it is possible that a few minority stock-holders might be willing to sell their shares, the overwhelm-ing majority wish to retain their investment. In other words, certainly at this time the management is unwilling to even discuss the question of a sale or merger of Simplex.

I might add that Ebasco's name was in no way mentioned during the conversation.

Sincerely yours, J. E. Toulmin.

[fol. 5808] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 400

bc—F. W. Ohles, R. E. Pierce

July 25, 1958.

Mr. Donald P. Horsey, Vice President
The Philadelphia National Bank
Fayette at Fifth Avenue
Conshohocken, Pennsylvania

Dear Mr. Horsey:

I wish to thank you for bringing our interest in Walker Brothers to the attention of the Board at its July 22 meet-ing.

Naturally we are disappointed Mr. Hervey Walker should

be so firm in his decision about an exchange of stock with our client. In the event there is a change in his viewpoint, I think it desirable to indicate that our client's interest may be continuing even though it acquires another company in this field.

We have to respect the request for confidentiality but some background leading up to our contact of you may be of interest in the event there is a reconsideration in the future.

As you know, we are not commission brokers and our interest is in helping a client with whom we have had a long business association as both customer and client and which has resulted in their high regard for our discretion and for our judgment in the utility field.

Our client is desirous of expanding into the electric utility supply field. It specified that any company we might suggest have a well engineered product of high quality; a competent management of high integrity; the management willing and able to stay on and run the company; and an exchange of stock preferred though a cash transaction will be acceptable.

Walker Brothers was one of a number of companies we suggested for consideration which was satisfactory. We, of course, would not remain in the picture if Mr. Walker sincerely wished to discuss this matter directly with our client, but until it was certain there was genuine interest our client did not want it known that it was seeking to diversify. Also, although it is not looking for a bargain acquisition, any arrangement must be fair to both parties.

[fol. 5809] The stock of our client is listed on the New York Stock Exchange and has a long record for continuous dividend payments. Its revenues run well into the hundreds of millions of dollars and its financial strength would not be taxed in the slightest by any acquisition we have so far suggested. We are quite proud to be associated with this organization and know that you and the Walker company would be also.

Thank you again for your intercession and hope you will visit us if you ever have the opportunity when in New York City.

Sincerely yours, Walter C. Huebner, Assistant Manager.

WCH:iz

[fol. 5810] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 401

August 1, 1958.

Confidential and Personal
Mr. Philip T. Coffin, General Sales Manager
Aluminum Company of America
Alcoa Building
Pittsburgh 19, Pennsylvania

Dear Mr. Coffin:

Enclosed are the memoranda on the four situations I discussed with you this afternoon. We are pursuing the investigation of the other two companies of our list of six. There is enclosed also a table giving a brief summary of the market price history for the three companies which have stock in the hands of the public.

Sincerely yours, Walter C. Huebner, Assistant Manager.

WCH:iz
Encl.
bc—F. W. Ohles, R. E. Pierce

(Copy)

[fol. 5811] Memorandum from Corporate Finance Department

July 17, 1958.

To: File
From: W. C. Huebner
Subject: The Okonite Company

There have been rumors circulated recently to the effect that both Kaiser and Phelps-Dodge were discussing acquisition with Okonite. On July 16 our assignment with respect to investigating the possible acquisition of Okonite was discussed with Mr. Edwin R. (Rex) Williams, Vice President (Special Situations) of Chase Manhattan Bank.

Okonite is a client of Chase and its account is under the supervision of Mr. Earle Allen, Vice President, Commercial Department, handling all accounts in the states of New York and New Jersey, with the exception of New York City proper. Mr. Allen was brought into the meeting and today visited Mr. Albert F. Metz, Chairman of the Board of Okonite at the company's headquarters in Passaic. The purpose of the meeting was to discuss with Mr. Metz, as his banker, the recent publicity given to possibility of the sale of Okonite and to ascertain validity of these rumors.

Mr. Allen told Mr. Metz, who is a close personal friend of his, that another client of the Chase is in a position to discuss acquisition with Mr. Metz if management was seriously entertaining any thought of selling the company.

Mr. Metz very emphatically assured Mr. Allen that Okonite was not seeking an acquisition with any other company, that in his opinion rumors of this sort were cast forth more to stir up a little action. Although the company's sales had fallen off along with the rest of the industry and there had been abnormal break-in expenses in connection with the new plant they had acquired from Studebaker in New Brunswick, New Jersey, things were beginning to work out, the new plant was operating satisfactorily, and the company was in no way in need of acquiring financial strength through merger or any other way. He told Mr. Allen that if there is any change in management's thinking with respect to a possible sale or merger, he would certainly advise the Chase of this immediately and would be very glad to discuss this with the Chase at that time.

WCH:iz
cc—F. W. Ohles, R. E. Pierce.

(Copy)

[fol. 5812] Memorandum from Corporate Finance Department

June 23, 1958.

To: File
From: W. C. Huebner
Subject: Simplex Wire and Cable Company

An interview with John C. Toulmin, Senior Vice President of the First National Bank of Boston, was had Friday a.m., June 20. The meeting was arranged by F. W. Ohles through Donald L. Miller, Vice President, for the purpose of discussing Simplex Wire and Cable Co.

1st Boston is the banker for Simplex but, despite this, has relatively little information about either the company or its management. Everett Morss runs the company very tightly and does all the bank contact work himself. About nine months ago Toulmin suggested consideration of his estate problem and the need of establishing a market for the stock. At that time Morss was not interested.

Mr. Toulmin said that he would again contact Everett Morss on the desirability of obtaining a marketable security. If the reaction is favorable, he will then sound him out with respect to an exchange of stock with a good company. It is planned to do this the coming week (last in June) and advise me of the results.

Although Mr. Morss (age 58) is not now concerned about his estate, other members of the family are and this may have a bearing on Mr. Morss' outlook. Mr. Toulmin was advised of the confidentiality of our request and he agreed to respect it.

WCH:ah
cc—F. W. Ohles.

(Copy)

[fol. 5813] Memorandum from Corporate Finance Department

July 25, 1958.

To: File
From: Mr. W. C. Huebner
Subject: Triangle Conduit & Cable Corporation

On July 22nd I discussed over the phone with Schuyler Van Vechten, Director of Triangle, our interest on behalf of an unnamed client in the acquisition of Triangle. There was a Board meeting yesterday, July 24th, and Mr. Van Vechten brought this matter to the attention of the Board. He called this morning to give me the reaction of the Board.

It was unanimously decided not to pursue this possible acquisition. Incidentally, Van Vechten, who is Vice President of Lee Higginson Corporation, appears to be the only outside director on the Board. Both Mr. McAuliffe and Mr. Slater, Chairman and President respectively, are definitely not interested in being part of a large organization even though continuing to run Triangle as a subsidiary. The present management is very well satisfied with the company as it is now operating and much prefers to continue as an independent company.

After passing on this decision and reaction of the Board, Mr. Van Vechten went on to comment that the company sales for the first six months of 1958 were $26,000,000 vs. $28,000,000 for the first six months of 1957. Last year had been a very good year for the company, with total sales of $56,300,000. However, a very good July and August are in prospect and the company expects to substantially better the 1957 results over the second half. Revenues for the full year 1958 are currently estimated by management at $65,000,000. The inference was given that Triangle could not hope to obtain a fair value for the company despite the favorable outlook during off year in the industry. Present book value of the stock is stated to be about $30,000,000 whereas management apparently feels it is worth $50,000,000. It may be that this wide discrepancy between management's thinking as to value and book value plays an important part in their reluctance to consider any merger possibility. I pointed

out to Mr. Van Vechten that we had participated in many merger and acquisition plans and that in all these fair value was the criterion for establishing terms rather than book value.

Although the Board had firmly refused any consideration of merging, Mr. Van Vechten thanked us for our interest in the company and said that he would definitely keep me informed of any change in management thinking.

WCH:es
cc:Messrs—F. W. Ohles, R. E. Pierce.

(Copy)

[fol. 5814] Memorandum from Corporate Finance Department

July 22, 1958

To: File
From: W. C. Huebner
Subject: Triangle Conduit & Cable Corporation

This company has had close banking ties with the Chase Manhattan Bank ever since its establishment in Brooklyn in 1916, although it is now located in New Brunswick, New Jersey. Mr. John R. Lynch, Assistant Treasurer, Borough Hall branch, has been the officer in charge of this account for Chase Manhattan. Mr. Joseph G. Slater who was recently made President of Triangle is a friend of Mr. Lynch who contacted him in connection with our interest as to the availability of Triangle for acquisition. Mr. Lynch informed Mr. Slater that he was making this inquiry on behalf of Ebasco Services.

Mr. Schuyler Van Vechten, Vice President, Lee Higginson Corporation, is also a Director of Triangle and we were referred to him by Mr. Slater via Mr. Lynch. Mr. Slater also advised Mr. Lynch that management was not interested at this time in selling the company. This morning I called Mr. Van Vechten and outlined for him generally the conditions under which it was proposed to acquire Triangle and the criteria laid down by our client in selecting a company for acquisition. These were:

—Competent management of high integrity.
—A well engineered product of high quality.
—Our client was not experienced in this field and it was essential that present management of Triangle would continue to run the company and be satisfied with any arrangement.
—Our client preferred that the acquisition be made through an exchange of stock.
—Our client is not looking to make a bargain acquisition. Wanted to arrange a fair deal for Triangle. However, it was essential that the deal be fair also to our client.

Mr. Van Vechten said it would be difficult to obtain any decision without knowledge of our client. He did agree, however, that it may be possible to determine if there was any interest on the general grounds outlined to the point of willing to discuss terms of a sale. At this point our client would be willing to disclose itself but for good reasons did not wish it known that it was seeking such a company until such time as it was necessary to do so.

Mr. Van Vechten indicated that 1958 sales would be on the order of $65,000,000 versus 1957 sales of $56,000,000 and inquired if our client was of sufficient size, say sales in excess of $100,000,000 a year, to be able to acquire Triangle. I told him that they were and its resources were sufficient to acquire Triangle for cash if such would seem necessary. Mr. Van Vechten opined that our client obviously was big enough.

There is to be a board meeting of Triangle on Thursday, July 24. Mr. Van Vechten will discuss this proposal at the board meeting and will advise me on Friday, July 25 as to reaction of the board.

WCH:iz
cc—F. W. Ohles, R. E. Pierce.

(Copy)

[fol. 5815] Memorandum from Corporate Finance Department

July 24, 1958.

To: File
From: Mr. W. C. Huebner
Subject: Walker Bros. of Conshohocken, Pa.

On May 27, 1958 Mr. John Rae visited his friend, Donald P. Horsey, Vice President of the Philadelphia National Bank and Manager of the Conshohocken branch, for the purpose of discussing Walker Bros., its management and the possibility that it might be available for acquisition. As a result of this meeting it appeared that an offer might be entertained by the owner-management. On July 10th I talked to Mr. Horsey more specifically and told him that a client of ours was definitely interested in acquisition through an exchange of stock of Walker Bros. Mr. Horsey is an outside director of Walker Bros. and has had a long business and personal association with the Company and the Walker family. He suggested that this matter be broached to the Board of Directors at the next meeting on July 22nd.

The decision of the Board was discussed with Mr. Horsey over the telephone today. In short, management is not now interested in any offer, no matter how favorable, involving the sale of the Company. Mr. Hervey S. Walker, Chairman of the Board, and his family are the sole shareholders of this Company. Despite the fact that he is 79 years of age he does not feel the need of establishing a market for his stock and feels that his estate is in good order. Mr. Horsey is of the opinion that this was a very firm refusal on the part of Mr. Walker but that other factors, such as any failing health on Mr. Walker's part, might change his viewpoint.

WCH:es
cc—Messrs F. W. Ohles, R. E. Pierce.

[fol. 5816] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 402

August 4, 1958.

Confidential and Personal
Mr. Philip T. Coffin, General Sales Manager
Aluminum Company of America
Alcoa Building
Pittsburgh 19, Pennsylvania

Dear Mr. Coffin:

Enclosed is a memorandum on the fifth of the six situations we were investigating.

Mr. Rudd said that he had read with interest the article in the New York Times with reference to possible acquisition of Okonite by Phelps-Dodge and also rumors to the effect that Kaiser and possibly Reynolds were interested in Okonite. In his own mind he may be associating the bank's approach to him with one of these companies.

Sincerely yours, Walter C. Huebner, Assistant Manager.

WCH:iz
Encl.
bc—F. W. Ohles, R. E. Pierce.

[fol. 5817] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 403

cc—Messrs F. W. Obles/W. C. Huebner

Confidential

January 9, 1959.

Memorandum from
Corporate Finance Department

To: F. C. Gardner
From: R. L. Schlesinger
Subject: Summary of Alcoa Assignment

On May 19, 1958, the Aluminum Company of America asked for assistance in acquiring a company in the utility electric cable field. The Alcoa officials who came to New York and made the request were Ralph V. Davies, Vice President, Director and General Sales Manager, and Phil Coffin, Manager of the Utilities Sales Division. Later, in Pittsburgh, Frank.L. Magee, President, and Matt Stanley, Assistant Treasurer were met also.

Certain criteria were laid down to guide our investigation:

Company must serve the utility industry
Product line be well engineered
Quality of production of high standard
Management must be compatible with Alcoa's, capable and of high integrity
Management to remain with company
Prefer acquisition through an exchange of stock and must obtain control, preferably 100%
If possible, location to be near Ohio River
Not interested in companies already affiliated with other primary metal producers

Phase I—Industry Pattern

The industry was studied to determine the companies engaged in this business and their relative position. There are about 120 companies in the field, including many subsidiaries and divisions of integrated metal companies.

Phase II—Selective Study

Upon completion of Phase I, a meeting was held with the client and a group of companies was selected for further review. Analysis was made in particular to determine their reputation as to technical ability and quality of management, financial position, and general availability. These companies were, in order of preference by Alcoa:

1. Okonite Company
2. Simplex Wire & Cable Co.
3. Triangle Conduit & Cable Corp.
4. Walker Brothers
5. Kerite Company
6. Crescent Insulated Wire & Cable Co.

Most of the other companies in the field, other than Rome Cable and General Cable, were either very small, divisions of integrated companies, or did not possess attractive fea- [fol. 5818] tures. Rome Cable was not included in the list because Alcoa had contacted it in October 1957. General Cable was also excluded because Alcoa was familiar with their management troubles and was averse to acquiring this headache.

Phase III—Approach

Okonite was selected for first approach. A. F. Metz, Chairman of the Board, was contacted. After considerable delay due to his nonavailability and other reasons, Metz agreed to a tentative meeting in late September of last year. Shortly prior to the meeting, it was announced that Kennecott was to acquire Okonite and this subsequently occurred. We believe that Okonite had an understanding with Kennecott while Metz was having telephone discussions with us.

Meanwhile our discussions with board members and bankers of the other companies had indicated lack of interest. Alcoa had acquisition discussions with Rome in 1957. They have recently been resumed. We have been in frequent contact with Alcoa during the current negotiations, and have furnished our preliminary views as to relative values and recommended course of action.

The death of the principal stockholder of Walker Broth-

ers of Conshohocken, Pa., occurred late last Fall. In December, we had discreet discussions with the trustee of the estate. Considerable time will have to elapse before further interest is developed.

We are in process of a second approach to Simplex of Cambridge, Mass. through the First National Bank of Boston. In the first approach Simplex was not aware of Ebasco's interest and John Toulmin, Senior Vice President of the bank simply discussed the possible sale of the Company with Everett Morss as a friend and banker.

At no time during any of our probing or discussing have we indicated that we represent Alcoa.

RLS:ac

[fol. 5819] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 405

Memorandum from
Corporate Finance Department

August 12, 1958.

To: W. C. Huebner
From: R. L. Schlesinger
Subject: MEFA

Mr. Philip Coffin telephoned concerning the item in the Wall Street Journal today indicating that Okonite and Kennecott are close to a share for share stock swap. Coffin indicated that, while it, of course, might only be a rumor, they were very surprised and even shocked to read it. He would like Okonite to know that before they make any final move, Coffin's company would like to sit down and talk with Metz and his associates concerning this matter. They believe that their diversity of interests and products offer considerable to Okonite.

Coffin suggested that we contact Chase Manhattan to relay this on to Okonite.

Earle Allen, Vice President—Commercial Department of Chase, was on vacation so spoke to Rex Williams and Wal-

ter Dahmer. They promised to contact Metz of Okonite immediately and to report back to us no later than tomorrow morning.

RLS:iz
cc—F. W. Ohles

[fol. 5820] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 406

Memorandum from
Corporate Finance Department

October 17, 1958.

To: File
From: Mr. R. L. Schlesinger
Subject: Triangle Conduit & Cable Co., Inc.

Telephoned Mr. Davies of Alcoa today and gave him our views and steps taken concerning Triangle in the light of the Okonite acquisition by Kennecott.

On a previous contact with Triangle through Mr. Van Vechten, a Director of Triangle and a partner of Lee Higginson, we have been advised that Triangle was not interested in joining an integrated company (or any other company). Van Vechten was contacted by Mr. Huebner today to generally discuss the matter again. Van Vechten indicated that there might be some slightly increased interest on the part of Triangle but was not at all sure and would bring the matter up at a Board meeting which would be held before the end of October.

It was suggested to Mr. Davies that Mr. Huebner and myself visit McAuliffe and Slater, Chairman and President respectively of Triangle, at New Brunswick, N. J. to discuss the matter with them. This would be done after we are advised of the Board's views as indicated during their meeting this month. Van Vechten promised to telephone us after the meeting and prior to his departure for Europe around the 1st of November.

Davies agreed that it would be desirable for us to visit

the Triangle people. In the meantime he is expecting a visit on October 20 from representatives of Rome Cable basically on another matter but expects to discuss this same area of interest during the meeting. I mentioned to Davies that there would seem to be no objection in pursuing both companies at the same time and he agreed. I mentioned to Davies that in view of Alcoa's past problems with Rome that an independent study by Ebasco or some other firm might be desirable to speed any possible progress. Emphasized to Davies that this suggestion was by no means a promotional effort.

The way the matter stands now seems to involve a visit by Ebasco representatives to Triangle, if they are willing, sometime around November 1. Davies was advised that there might be a gap of some ten days before he hears from us again.

RLS:es

[fol. 5821] Triangle

Gold, Sec.	36,000
Hohl V.P.	26,000
Mc Auliffe, Chairman	216,000
Mc Kay, V.P.	4,100
Menger, V.P.	250
Slater, J. G., Pres.	24,000
Slater, J. M. Treas.	206
Van Vechten, Director	200
	306,756 (22.6%)
Total outst—about	1,359,000

[fol. 5822] Stock Ownership Information—Triangle Conduit and Cable

E. C. Gold—Secretary & Director
As of 1/2/58 owned 35,600 shares
As of 11/57 owned 31,000 shares
As of 1/2/58 gift of 400 shares to relatives

Henry D. Hohl—Vice Pres. (Prod.) & Director
As of 11/57 owned 25,940 shares

John E. McAuliffe—President & Director
As of 11/57 owned 216,100 shares

Clyde V. McKay—Vice Pres. & Asst. to Pres.
As of 11/57 owned 4,100 shares

Carl S. Menger—Vice Pres. (Sales)
As of 11/57 owned 250 shares

Joseph G. Slater—Exec. V. P., Treas. & Director
As of 11/57 owned 24,000 shares

J. M. Slater—Treasurer
As of 5/6/58 owned 206 shares

[fol. 5823]

Schuyler Van Vechten—Director (c/o Lee Higginson)
As of 11/57 owned 200 shares

[fol. 5824] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 408

cc F. W. Ohles/W. C. Huebner

October 29, 1958.

Memorandum from
Corporate Finance Department

To: File
From: R. L. Schlesinger
Subject: Rome Cable Corporation

Mr. Davies of Alcoa telephoned after his meeting today with Herbert Dyett of Rome Cable to advise us of what transpired at the meeting. Dyett is prepared to accept 8/10ths of a share for each share of Rome stock. He is leaving for Florida and would like Alcoa's views telephoned to him down there. Told Davies that in our judgment Dyett's offer was outside of any range of reasonableness. Davies said he was returning to Pittsburgh this afternoon and he would appreciate learning our progress on Triangle. Told him I would contact him as soon as possible and that in the meantime we would work up some figures on the Rome matter.

October 30, 1958.

W. C. Huebner received a phone call from Van Vechten, Director of Triangle. Van Vechten indicated that our approach to Triangle had been discussed at length at Triangle's Board of Directors meeting on Oct. 28. Triangle again indicated their lack of interest in this matter. Their confidence in their own future was indicated in the extra dividend (5¢) declared at the Board meeting.

Telephoned Davies and reported the status of the Triangle matter. Mentioned that although it is indicated that a further move in that direction in their behalf was inadvisable, it would not necessarily completely close it out indefinitely.

Discussed Rome matter again. Suggested that he give Dyett a fast answer indicating lack of interest in the 8/10ths offer but willingness to consider a reasonable offer. Davies

agreed completely and said he would telephone Dyett in Florida tomorrow. Davies believes Dyett's offer is a firm one and not subject to negotiation. Replied to him that he would have to be the best judge of this since he dealt with Dyett in person but it did seem to us that Dyett was maneuvering for at least the offer made by Alcoa a year ago (322,000 shares of Alcoa). Told Davies that based on the quick look we had made, in our judgment their previous offer was generous. Mentioned that of course we did not consider possible benefits to Alcoa through acquisition. Davies seemed to agree that their last offer was on the generous side.

Told Davies we had briefly looked into the matter from the standpoint of an offer ranging from 4/10th to 8/10th of a share. Within this range and using a price of 85 for Alcoa with 558,000 shares of Rome common stock outstanding, the following data were obtained:

[fol. 5825]

	Exchange Bases				
	.4	.5	.6	.7	.8
Shares Alcoa Issued (000)	223	279	335	391	446
Value @ 85 ($000)	18,955	23,715	28,475	33,235	37,910
Value pres. sh. Rome ($)	33.97	42.50	51.03	59.56	67.94
Return on Investment at $2 million earn. of Rome (%)	10.6	8.4	7.0	6.0	5.3
Alcoa div. requirement @ $1.20	268	335	402	469	535

Suggested to Davies that we approach Walker Bros. and Kerite in that order although both indicated lack of interest on previous contacts. Davies approved of this.

W. C. Huebner contacted Donald P. Horsey of the Philadelphia National Bank, the one outside director of Walker Bros. Horsey advised that Hervey Walker, Chairman of the Board of Walker Bros. and largest stockholder, had just died and that Horsey was named one of the trustees of his estate. He indicated that there probably would be no interest in any possible acquisition by another company—at least not for two years. He indicated further that Walker's estate was liquid and furthermore there are competent people running the company. This last development has not yet been reported to Mr. Davies.

RLS:ah

[fol. 5826] IN UNITED STATES DISTRICT COURT

2641

PLAINTIFF'S EXHIBIT 409

This report is mandatory under authority of the Defense Production Act of 1950, as Amended.

BUDGET BUREAU NO. 41-R1621.4
APPROVAL EXPIRES DECEMBER 31, 1960

Form BDSAF-122
(1-7-9)
R

Report for month of

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
and
BUSINESS AND DEFENSE SERVICES ADMINISTRATION

(Please correct if name or address has changed)

Form BDSAF-122

ALUMINUM PRODUCERS AND IMPORTERS

MONTHLY REPORT OF RECEIPTS, SHIPMENTS, AND STOCKS

TO: Bureau of the Census, Washington 25, D.C.
ATTN: Industry Division

GENERAL INSTRUCTIONS

Two (2) copies of this report shall be filed at the above address each month, not later than the tenth (10th) day following the month covered by the report, by: integrated producers; non-integrated producers; smelters; other producers of secondary ingot, including reclaimers producing deoxidizing and chemical grades, and foundries which purchase and melt scrap; importers; foil fabricators; powder manufacturers; and forging companies. Distributors are not required to file this form. A report need not be filed for any month in which the total shipments are less than 10,000 pounds. In such case, please indicate by checking in the box following this paragraph and return the form without completing.

☐ Less than 10,000 pounds.

SPECIFIC INSTRUCTIONS

Section I - TOTAL RECEIPTS AND SHIPMENTS

Columns (c) and (d) - Receipts
Producers should report in thousands of pounds the weight of products listed in Column (a) which was received from imports and from other sources, separately, for use in producing products listed. Report metal actually received, including metal received under toll arrangements. If you operate both as a producer and as a distributor, receipts for resale should be excluded. Smelters should not include ingot from reclaimers as receipts of ingot. Smelters producing non-aluminum-base alloys, e.g. zinc-base, should not include as receipts the pig or ingot used in producing such alloys.

Column (e) - Shipments
Report in thousands of pounds the weight of products in Column (a) shipped to all customers, including shipments to outside companies and companies in which you have an interest; shipments within your company for fabrication beyond the shapes listed in Column (a); and shipments made under toll arrangements. Do not include shipments to GSA in Section I; but report these as a separate item in Section II. If you operate both as a producer and as a distributor, omit shipments of shapes purchased for resale. Report the product shipped in its most advanced form as listed in Column (a). Do not report as a shipment the stock you produce which is required to produce that product. For example, a company making both redraw rod and wire should report wire but not the redraw rod from which the wire was produced. A company making both forging stock and forgings should report forgings as shipments but not the stock from which the forgings were produced. Foundries purchasing and melting scrap should report as shipments the ingot equivalent of scrap purchased and used in the foundry operation.

Section II - SHIPMENTS ON RATED ORDERS

Columns (a) and (b) - Products and Product Code
Report product codes and designations of products shipped on rated orders, according to list in Section I. Companies supplying metal to foil producers, powder manufacturers and forging plants for military orders should not report rated shipments of such metal as A-E orders but as AF, AP, and Forging Stock orders, respectively; foil producers, powder manufacturers and forging plants will report rated shipments of their products as A-E orders.

Column (c) - Allotment Symbols
Show the allotment symbols (A-E and 1 digit and AM numbers) used by your customers in placing orders against which you have shipped during the month. AM 9000 is the symbol used by distributors in replacing in inventory material shipped by them on rated orders. Show shipments to GSA as a separate item.

Column (d) - Shipments
Report the weight in thousands of pounds of each product shipped against individual ratings.

Section III - INVENTORIES OF SCRAP, PRIMARY PIG AND INGOT, AND SECONDARY INGOT

Report weight in thousands of pounds of inventories at end of month of (1) purchased scrap or scrap received on toll including ingot received from reclaimers, (2) primary pig and ingot, unremelted, (3) secondary ingot, including toll, unremelted.

Certification - The undersigned company and the official executing this certification on its behalf hereby certify that the information contained in this report is correct and complete to the best of their knowledge and belief.

Name of company

Signature of authorized official

Date

Title

The U. S. Code, Title 18 (Crimes and Criminal Procedure), Section 1001, formerly Section 80, makes it a criminal offense to make a wilfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction. The individual company information reported on this form is for use in defense mobilization activities. The unauthorized publication or disclosure of individual company information is prohibited by law, and persons having access to such information are subject to fine and imprisonment for unauthorized disclosure.

USCOMM-DC 6700-P

Section I - TOTAL RECEIPTS AND SHIPMENTS (Report in thousands of pounds)[1]

Product (a)	Product code (b)	Receipts from imports[2] (c)	Other receipts (d)	Shipments (e)
Extrusion ingot (billet)	130			
Other primary pig, ingot, and molten metal	120			
Other secondary ingot	110			
Sheet and plate (.006" and over)				
Non heat-treatable	011			
Heat-treatable	012			
Foil (under .006"), including foil in lamination	020			
Rolled and continuous cast, rod and bar[3]	030			
Wire, bare, conductor and nonconductor	040			
ACSR and aluminum cable, bare	050			
Wire and cable, insulated or covered	055			
Rolled structural shapes	060			
Extruded shapes, alloys other than 2,000 and 7,000 series	071			
Extruded shapes, alloys in 2,000 and 7,000 series	072			
Drawn tube, alloys other than 2,000 and 7,000 series	073			
Drawn tube, alloys in 2,000 and 7,000 series	074			
Welded tube, non-heat-treatable	075			
Welded tube, heat-treatable	076			
Powder and paste				
Atomized	100			
Flaked	101			
Paste	102			
Forgings (including impact extrusions)	150			

[1] Report aluminum and aluminum alloy content only.
[2] Report only imports made through regular importers.
[3] 3/8" and over, maximum diameter across flats.

Section II - SHIPMENTS ON RATED ORDERS (If more space is required, report on blank pages and attach.)

Product (a)	Product code (b)	Allotment symbols (c)	Shipments (Thousands of pounds) (d)
		....4124....	

Section III - INVENTORIES OF SCRAP, PRIMARY PIG AND INGOT, AND SECONDARY INGOT (as of end of month)

Item No.	Item	Amount (Thousands of pounds)
	[Sc]rap (purchased or received on toll including ingot received from reclaimers)	
	[Pr]imary pig and ingot, unremelted	
	[Se]condary ingot	

[Com]pany	Name and title of official to be contacted	Telephone No.	Date

10-11

Form [illegible]-123 (1-7-50) USComm-DC 6700-P

[fol. [illegible]828] IN UNITED STATES DISTRICT COURT

2643

PLAINTIFF'S EXHIBIT 410

Form approved Budget Bureau No. 41-R1585.7

This report is required under Section 705 of the Defense Production Act of 1950, as amended.

Report for quarter of

FORM BDSAF-84
(2-10-60)

U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
COLLECTING AND COMPILING AGENT FOR
BUSINESS AND DEFENSE SERVICES ADMINISTRATION

COPPER CONTROLLED MATERIALS

PRODUCERS PROGRAM REPORT

BRASS MILLS AND COPPER WIRE MILLS

Name and address of company (*Street, City, Zone, State*)
(*Please correct if name or address has changed*)
Form BDSAF-84

TO: Bureau of the Census, Washington 25, D.C.
ATTN: Industry Division, Ref: BDSAF-84

INSTRUCTIONS

File in *duplicate* with the above address not later than the *15th* of the month following the quarter of report. Report all weights in thousands of pounds (000 omitted). Show total metal weight for all products, except for copper wire mill products, which are to be reported in copper content. Companies having both brass mill and wire mill operations will file a separate report for each operation. Please read instructions attached to "File Copy" before preparing this form.

RETAIN THIS FILE COPY

Type of operation (*Check one*) ☐ Copper wire mill ☐ Brass mill

Section 1 - COPPER AND COPPER-BASE ALLOY CONTROLLED MATERIALS SHIPMENTS AND UNFILLED ORDERS
Report all figures in thousands of pounds - metal weight (*Copper content for wire mill products*)

Item No.	Item (a)	Product Code	Leave blank (For BDSA Use Only)		DELIVERY ORDERS Total (b)	Other than ACM (c)	ACM (d)
1	Total copper wire mill products (*Sum of Items 1a, b and c*)	70		SHIPMENTS			
1a	Wire, uninsulated, bare, tinned, and/or alloy coated	71					
1b	Insulated wire and cable Communication wire and cable	74					
1c	Other insulated wire and cable	76					
2	Total brass mill products (*Sum of Items 3 through 9*)	05					
3	Copper-base alloy Sheet	10					
4	Military cups and discs	15					
5	Rod	20					
6	Tube	30					
7	Unalloyed Sheet	40					
8	Rod	50					
9	Tube	60					
10	Unfilled orders						

Please complete form and sign certification on reverse

USCOMM-DC 7090-P60

Section II - AUTHORIZED CONTROLLED MATERIALS SHIPMENTS BY DMS ALLOTMENT NUMBER

Report all figures in thousands of pounds - metal weight - (Copper content for wire mill products)

Item No.	Allotment number	Code	Copper wire mill products (70)	Brass Mill Products: Alloy: Sheet (10)	Alloy: Military cups and discs (15)	Alloy: Rod (20)	Alloy: Tube (30)	Unalloyed: Sheet (40)	Unalloyed: Rod (50)	Unalloyed: Tube (60)
11	A-1	3011								
12	A-2	3012								
13	A-3	3013								
14	A-6	3016								
15	A-7	3017								
16	All other "A" series allotment numbers	3019								
17	Total A series *(Sum of items 11 through 16)*	3010								
18	Total B series	3020								
19	Total C series	3030								
20	Total D series	3040								
21	Total E series	3050								
22	For BDSA Use									

Remarks

Certification - The undersigned company and the official executing this certification on its behalf, hereby certify that the information contained in this application or report is correct and complete to the best of their knowledge and belief.

Name of company _______________ By _______________ Signature of authorized official

Date _______________ Title _______________

The U.S. Code, Title 18 (Crimes and Criminal Procedure), Section 1001, makes it a criminal offense to make a wilfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction. The individual company information reported on this form is for use in defense mobilization activities. The unauthorized publication or disclosure of individual company information is prohibited by law, and persons having access to such information are subject to fine and imprisonment for unauthorized disclosure.

[fol. 5830]

GENERAL INSTRUCTIONS

This report is required under the authority of Section 705 of the Defense Production Act of 1950, as amended.

1. Brass mills whose average monthly shipments of brass mill products (excluding shipments of intermediate shapes) was more than 200,000 pounds (metal weight) during the last six months of 1952 and copper wire mills whose average monthly shipment of copper wire mill products (excluding shipments of intermediate shapes) was more than 100,000 pounds (copper content) during the last six months of 1952 shall file a report on this form in *duplicate (2)* by the *15th* of the month following the period of report with the Bureau of the Census, Washington 25, D.C., Industry Division, REF: BDSAF-84.

2. This form shall be filed for each calendar quarter. The period of report is the calendar quarter just completed.

3. Shipments - Include all controlled materials orders shipped: by you for your own account; by other copper controlled materials producers for your account; or by you under toll arrangements for the account of controlled materials consumers. Include transfer of finished products from your company's mill to its fabricating plant(s). Exclude from this report actual shipments of controlled materials on toll basis to other producers of controlled materials. Also exclude transfer of products from your company's mill to mill stocks located elsewhere, for example, at depots. Include, however, shipments from your mill stocks at depots and warehouses to customers.

4. Unfilled Orders - Include all delivery orders for controlled materials (finished copper-base mill products as shown in paragraph 9 below) that have been accepted or acknowledged and have been scheduled for future production or delivery and for which controlled materials have not been shipped as of the close of business on the last day of the period covered by this report.

5. Unless otherwise directed by the Copper Division, companies operating more than one plant may file separate reports covering the operations of each plant, or may file a consolidated report covering all of their plants. Do not file both ways. If a company operates more than one plant, indicate under "name of company" on the report whether it is "individual" or "consolidated." Companies operating more than one plant are requested not to change method of filing without prior approval of the Copper Division.

6. Check (✓) in the space provided on the form the type of operation performed by your company.

7. In reporting weights, show total metal weight for all brass mill products; show copper content for wire mill products. Report all weights in thousands of pounds to the nearest thousand (000 omitted). *Example:* 6,849 as 7; 6,499 as 6; 720 as 1; amounts less than 500 pounds require no entry.

8. Do not include in this report copper raw materials, or brass mill or copper wire mill intermediate shapes. Include only brass mill products (including anodes, rolled, forged, or sheared from cathodes) and copper wire mill products, as listed in paragraph 9 below.

9. Separate information should be filed for each copper or copper-base alloy product that you produce. The following categories are classed as products for the purpose of this report.

Wire mill:
a. Copper wire mill products.
Wire, uninsulated, bare, tinned, and/or alloy coated.
Insulated wire and cable:
Communication wire and cable.
Other insulated wire and cable.

Brass mill:
a. Copper-base alloy sheet, plate, rolls, and strip, including anodes; but excluding strip for cupping and discing for military ammunition.

b. Military ammunition cups and discs, brass (net weight).

c. Copper-base alloy rod, bar, wire, and shapes.

d. Copper-base alloy pipe and seamless tubing.

e. Unalloyed copper sheet, plate, rolls, and strip, including anodes.

f. Unalloyed copper rod, bar, wire, and shapes, including anodes; but excluding copper wire mill products.

g. Unalloyed copper pipe and seamless tubing.

Abbreviated classifications appear on the Form as follows;

Brass mill:
a. Alloy sheet.
b. Military cups and discs.
c. Alloy rod.
d. Alloy tube.
e. Unalloyed sheet.
f. Unalloyed rod.
g. Unalloyed tube.

SPECIFIC INSTRUCTIONS

SECTION I

SHIPMENTS - Delivery Orders

Column (b) - Total. Report in this column for Items 1 through 9 the sums of items in columns (c) and (d). These sums represent the total shipments made on Authorized Controlled Materials orders and on delivery orders other than Authorized Controlled Materials orders during the period of report in accordance with the classification of copper-base mill products in column (a).

Column (c) - Other than ACM Delivery Orders. Report in this column for Items 1 through 9 all shipments made on non-ACM orders for copper and copper-base alloy controlled materials.

Column (d) - ACM Delivery Orders. Report in this column for Items 1 through 9 the totals of all Authorized Controlled Materials shipments against DMS allotment numbers extended to you by your customers, by toll consumers of controlled materials and by distributors. Do not include orders that have been cancelled. Entries in this column for Items 1 and Items 3 through 9 shall be the totals for all data for allotment numbers for each "Product" in Section II.

Items 1 through 9 - Enter data on the appropriate lines according to the classification of mill products shipped. Brass mills will enter for Item 2 the sum of data reported for Items 3 through 9.

UNFILLED ORDERS - Delivery Orders

Item 10 - Unfilled Orders - Report on this line all delivery orders for controlled materials (finished copper-base mill products as shown in paragraph 9 under General Instructions) that have been accepted or acknowledged and have been scheduled for future production or delivery and for which controlled materials have not been shipped as of the close of business on the last day of the period covered by this report.

Column (b) - Total. Report in this column for Item 10 the sum of data in columns (c) and (d).

Column (c) - Other than ACM Delivery Orders. Report delivery orders other than Authorized Controlled Materials delivery orders, that have been accepted or acknowledged and have been scheduled for future production or delivery and for which controlled materials have not been shipped as of the close of business on the last day of the period covered by this report.

Column (d) - ACM Delivery Orders. Report in this column for Item 10 all ACM delivery orders that have been accepted or acknowledged and have been scheduled for future production or delivery and for which controlled materials have not been shipped as of the close of business on the last day of the period covered by this report.

SECTION II

1. Report in this section Authorized Controlled Materials Shipments. Enter opposite each allotment number in the appropriate "Product" column the total of all shipments of the "Product" bearing that allotment number.

2. ACM shipments bearing program identification symbols A,B,C,D, and E should be totaled for each "Product" and entered for appropriate Items in column (d), Section I.

NOTE: You should not receive nor report those ratings with a DO prefix, such as DO-A-1. The DO prefixed rating applies to orders for products and materials other than controlled materials (see DMS Regulation No. 1.) DMS means Defense Materials System.

Plaintiff's Exhibit 421a

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
preprinted from BULLETIN 585

ALUMINA AND BAUXITE

BY R. C. WILMOT

a chapter from

MINERAL FACTS AND PROBLEMS, 1960 EDITION

1910
THE BUREAU OF MINES 50TH ANNIVERSARY
1960

[fol. 5832]

UNITED STATES DEPARTMENT OF THE INTERIOR • Fred A. Seaton, Secretary

BUREAU OF MINES • Marling J. Ankeny, Director

This publication is a chapter from Bulletin 585, MINERAL FACTS AND PROBLEMS, 1960 edition. The complete volume, covering all mineral commodities, may be purchased from the Superintendent of Documents, Washington 25, D.C. at a date to be announced later.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. - Price 10 cents

[fol. 5833]

ALUMINA AND BAUXITE

By R. C. Wilmot[1]

ALUMINA (Al_2O_3), the raw material for producing aluminum, comprises one-seventh of the earth's crust. Although bauxite is the only commercial ore of alumina, other potential sources of alumina are almost unlimited.

SUMMARY

World consumption of alumina in 1958 was estimated at 8 million tons; nearly 57 percent was consumed in North America and 38 percent in Europe. The consumption of alumina in the United States in 1958 was about 3.2 million tons, and by 1975 annual consumption may be 12 million tons.

World bauxite production in 1958 was estimated at 20.7 million tons, of which 57 percent was produced in the Western Hemisphere. Over 90 percent of the bauxite consumed in the United States is used in alumina production and the remainder by abrasive, chemical, refractory, and other industries. Bauxite consumption in the United States was 7 million tons in 1958 and by 1975 consumption may be 25 million tons.

Although the United States produces essentially all of its alumina requirements and is the world's largest consumer of bauxite, less than 20 percent of its bauxite requirement is produced domestically. The domestic bauxite reserve, which occurs mainly in Arkansas, is estimated at 50 million tons averaging about 52 percent Al_2O_3. The reserve is too small to permit production to be expanded significantly. The total world reserve of bauxite at the end of 1958 was estimated at 3.2 billion tons, with the largest deposits in Guinea, Australia, Jamaica, Hungary, Ghana, and Surinam.

As a result of improvements in technology it has been possible to reduce the grade of ore used in alumina plants. In 1930 ores used in the United States averaged 60 percent alumina, but by 1958 ore averaging as little as 50 percent alumina was being used. The average grade of ore treated will probably continue to decrease gradually, and successful application of processes now being tested would result in some plants using materials containing less than 35 percent alumina.

Bauxite, an ore containing hydrated aluminum oxide minerals such as gibbsite, boehmite, or diaspore, is formed by weathering processes acting on alumina-bearing rocks. The largest deposits occur in tropical or subtropical climates and are at or near the surface. Most bauxite is mined by open-pit methods, but bauxite is also recovered by underground mining methods in the United States and in Europe.

Assurance of an adequate and dependable long-range supply of alumina requires discovery of new sources and the solution of numerous mining and metallurgical problems. A challenging problem is the development of a commercial process for producing alumina from domestic low-grade materials. Problems of the Bayer process include the need to improve its efficiency and development of methods for utilizing tailings. There is insufficient information on quantity, grade, and type of potential alumina resources, and exploration is handicapped by lack of a rapid method of analyzing for alumina. Mechanical beneficiation of low-grade bauxites is hampered by the high loss of alumina in removing iron and silica.

[1] Commodity specialist.

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BACKGROUND

SIZE, ORGANIZATION, AND GEOGRAPHIC DISTRIBUTION OF THE INDUSTRY

World alumina consumption in 1958 was estimated at about 8 million tons, of which 40 percent was consumed in the United States, 38 percent in Europe, and 17 percent in Canada. Usually, alumina plants are in or near the consuming country. Most alumina production facilities of the world are owned by aluminum producing companies.

World bauxite production in 1958 was estimated at 20.7 million tons, of which 57 percent was produced in the Western Hemisphere. Major producing countries in the Western Hemisphere are Surinam, British Guiana, and Jamaica. Production was begun in Jamaica in 1952, and by 1957 that country was the world's leading producer with an output of 4.6 million tons.

The capacity and location of the United States alumina plants, their sources of bauxite, and the aluminum plants that consume most of the alumina production are shown in figure 1. Approximately 95 percent of alumina shipments in 1958 went to the aluminum industry; the remainder was shipped to abrasive, refractory, chemical, or other plants. Harvey Aluminum, Inc., when in full production, will import about 100,000 short tons of alumina a year from Japan.

Six alumina plants used about 93 percent of the bauxite consumed in 1958. The remaining 7 percent was consumed by about 150 widely distributed companies for abrasive, refractory, chemical, and other uses. Three of the four alumina producers are vertically integrated from the mine through production of semifabricated aluminum. The fourth company uses bauxite purchased from a foreign source. In 1958 six independent companies produced bauxite in the United States on a small scale, mainly for specialty uses. All ore from Alabama and Georgia, some from Arkansas, and part of the South American imports, which total approximately 600,000 tons a year, is consumed directly in the form of bauxite without passing through an intermediate alumina production stage.

Bauxite exports represented less than 1 percent of the new supply.

DEFINITION OF TERMS, GRADES, AND SPECIFICATIONS

Alumina is aluminum oxide, Al_2O_3, prepared by calcining $Al_2O_3 \cdot 3H_2O$ at approximately 2,000° F. Naturally occurring forms include corundum, emery, ruby, and sapphire. In the commercial form it is a fine white powder containing about 0.5 percent impurities. A typical analysis of alumina used in the production of aluminum follows:

	Percent
Chemical composition:	
Silica (SiO_2)	0.02
Iron Oxide (Fe_2O_3)	.02
Titanium dioxide (TiO_2)	.003
Phosphorus pentoxide (P_2O_5)	Nil
Potash (K_2O)	Nil
Sulphur trioxide (SO_3)	Nil
Soda (Na_2O)	.45
Calcium oxide (CaO)	.02
Lead (Pb)	Nil
Alumina (Al_2O_3)	Bal.
Ignition loss and water absorption:	
Loss on ignition (1,000° C.)	2.67
Water absorption (bone dry-basis)	3.16
Screen analysis (Tyler mesh):	
+48	Nil
−48+100	.5
−100+200	53.5
−200	46.0
−325 (wet on original sample)	12.0

Activated alumina is a highly porous and granular form of aluminum oxide having preferential adsorptive capacity for moisture from gases, vapors, and some liquids. When saturated, it can be reactivated by the controlled application of heat within the temperate range of 350° to 600° F. to drive off the moisture. It is used as a drying agent, catalyst, or catalyst carrier.

Tabular alumina, also Al_2O_3, is prepared by heating $Al_2O_3 \cdot 3H_2O$ to slightly below the fusion point of alumina (3,700° F.). It is used in refractories, in insulators, and as a filler in plastics.

Bauxite is the term used for ores containing monohydrate or trihydrate aluminum oxide minerals, used primarily in the production of alumina. Most of the aluminum oxide (Al_2O_3) is present as gibbsite, boehmite, or diaspore. Major impurities in the ore are iron oxides, aluminum silicates, and titanium oxides.

There are three types of bauxite. The Surinam or trihydrate type is mainly gibbsite ($Al_2O_3 \cdot 3H_2O$) and usually contains 50 percent or more alumina, 2 to 15 percent silica, and 5 to 15 percent iron oxide. The European or monohydrate ($Al_2O_3 \cdot H_2O$) type is composed of boehmite or diaspore. A typical European-type ore analyzes 55 percent alumina, 4 percent silica, and 10 to 20 percent iron oxide. The Jamaica or mixed type is a mixture of monohydrate and trihydrate minerals. It contains about 50 percent alumina, 1 to 2 percent silica, and 20 to 30 percent iron oxide.

Crude bauxite, or bauxite as mined, contains amounts of free moisture ranging commonly from 5 to 25 percent and, in domestic ores, averaging about 15 percent.

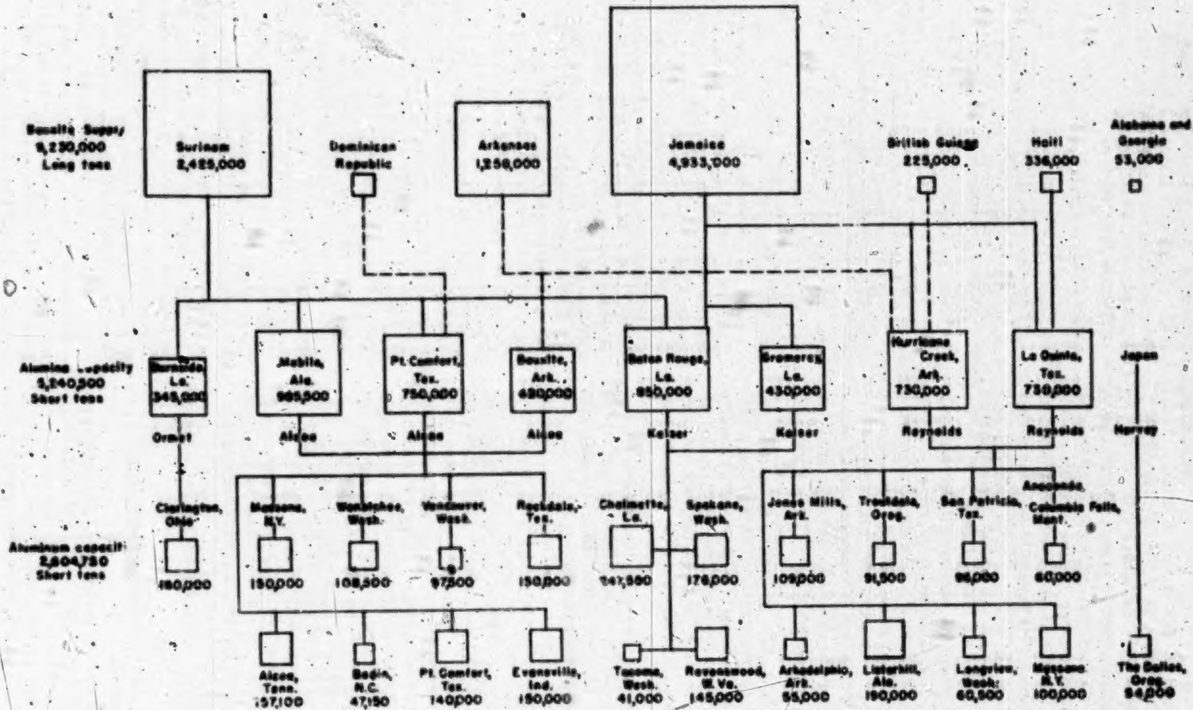

Figure 1.—Bauxite Supply and Alumina- and Aluminum-Plant Capacities in the United States in 1958 (Includes Plants Under Construction).

Bauxite specifications vary with plant and ultimate use. Table 1 gives the chemical analyses of bauxites used by the metallurgical, abrasive, chemical, and refractory industries. National stockpile specifications for all grades except chemical have been established (*3*).[1]

TABLE 1.—*Chemical analysis of typical bauxites by grade*

[Percent]

Grade	Al_2O_3	SiO_2	Fe_2O_3	TiO_2
Metallurgical	50-65	0-15	5-30	
Abrasive	Min. 85	Max. 5	Max. 6	Min. 2.5
Chemical	Min. 55-58	Max. 5-12	Max. 2	
Refractory	Min. 59-61	Max. 1.5-5.5	Max. 2	Max. 2.5

[1] Most of the remainder represents water of crystallization.

Red mud, the residue that results after alumina is extracted from bauxite by the Bayer process, consists largely of a complex sodium aluminum silicate and iron oxides. In the combination process the red mud is the feed to a subsequent lime-soda sinter step. The residue from the combination process is called brown mud or sinter mud and contains calcium silicates and iron oxides but little sodium aluminum silicate.

TECHNOLOGY

GEOLOGY AND EXPLORATION (*3*)

The commercial production of alumina is derived almost entirely from the hydrated oxides of aluminum contained in bauxite. Potential nonbauxitic sources are the aluminum sulfates such as alunite formed from hydrothermal solutions; the aluminum silicates such as the feldspars formed by igneous intrusions the aluminum silicates such as the andalusite-sillimanite series formed in schist belts by metamorphism; and the hydrated aluminum silicates such as clay formed in beds by the processes of weathering and sedimentation.

Bauxite is formed by the weathering of alumina-bearing materials such as feldspars or clays. Ideal conditions, most likely to occur in wet tropical or subtropical climates, are nearly continual rainfall, constant warm temperatures, and relatively good drainage over a long period of time (*1*, *16*). The formation of hydrated aluminum silicates or hydrated aluminum oxides is strongly influenced by the degree of acidity or alkalinity of the weathering solutions. The Arkansas bauxite deposits were formed by weathering of nepheline syenite intrusions during the period between the formation of the Midway marine clays and the deposition of the Saline formation of the Wilcox group of continental sediments. Some later transported deposits were formed in the unconsolidated clays and sands near the syenite stocks.

[3] Italicized numbers in parentheses refer to items in the bibliography at end of chapter.

Bauxite forms on a wide variety of rocks. European and Jamaican bauxites are frequently found in the sinkholes on the erosion surfaces of limestones. Indian bauxites are associated with basalts, and the bauxites of Western Africa and the Guianas in South America are associated with the weathering of schistose rocks. Many of the largest deposits are of the Pliocene or later ages and are covered by little, if any, overburden.

Prospecting is done along the unconformable surfaces on which the weathering interval was suitable for the formation of bauxite. There is no rapid method of chemical analysis for alumina, but differential thermal methods have been developed for quick approximations of the kaolinite and gibbsite content of samples.

Since bauxite forms by weathering, the ore body, which may be buried by normal geological processes, is usually nearly horizontal and close to the surface. Initial drilling is done at 400- to 4,000-foot intervals and development drilling at 50- to 200-foot intervals, depending on the depth and continuity of the deposit.

MINING

Open-pit mining accounts for 80 percent of the bauxite produced in the United States, also accounts for most of the bauxite produced in the rest of the world except Europe. In Arkansas, stripping is done by draglines, shovels, and carryalls. Stripping ratios of as much as 10 feet of overburden to 1 foot of ore are used and a ratio of 15 to 1 is considered feasible. Several pits in Arkansas have been mined to depths of more than 100 feet, and about 200 feet is estimated to be the present economic limit for large ore bodies. The pits stand well for unconsolidated rocks, but slumping does occur. Bauxite deposits in Jamaica lie at the surface, and stripping is limited to vegetation and topsoil (*11*). In Surinam, as much as 80 feet is stripped by draglines, hydraulic giants, or dredges (*22*).

Underground mining accounts for more than 80 percent of French bauxite production and is widely used in other parts of Europe including the U.S.S.R. European deposits frequently are in steeply folded limestone beds, and the ore-shoot pattern is typical of sinkhole deposition. Room-and-pillar or shrinkage stoping is used, depending on size, dip of the ore body, and condition of the back.

The flat-lying underground deposits of the United States are worked by room-and-pillar or longwall methods. The unconsolidated lig-

nitic clays and sandstones of the back are weak and must be supported by a cap of bauxite about 2 feet thick. A modified longwall method, which retreats by mining diamond-shaped rooms along a cave line, has been developed by Reynolds Mining Co. for use in its Hurricane Creek mine in Arkansas. Using this method, average recoveries of the ore mined were about 80 percent, although in soft parts of the ore body recovery may be as low as 50 percent.

Restoration of mined-out open-pit areas to usefulness is required in Jamaica and is becoming increasingly important in other areas. Subsidence where bauxite was extracted underground is of minor importance today but may become more serious in the future.

BENEFICIATION

Bauxite is often washed to remove silica or clay minerals. The high-iron ores of Surinam are concentrated by jigging or heavy-medium separation.

In submarginal bauxites the iron oxides, clay minerals, and part of the titanium minerals are often so finely dispersed through the ore that physical methods have not produced successful separations.

During World War II a pilot plant was operated by the Bureau of Mines at Bauxite, Ark., to test various ore-dressing procedures, including gravity, flotation, and magnetic methods (*20*). Beneficiation by magnetic techniques to eliminate iron is practiced on a limited scale on bauxite for nonmetallurgical uses (*5*).

PROCESSING

Although research on the extraction of alumina has continued for many years, virtually all of the commercially produced alumina is obtained by a process patented by Karl Bayer in 1888 (German Patent 43,977) for use on bauxite. A number of modifications and improvements have been made in the process to adapt it to various types of bauxite. The process involves a caustic leach at elevated temperature and pressure, followed by separation of the resulting sodium aluminate solution and selective precipitation of the alumina. There are two principal variations of the Bayer process: (1) The European Bayer, in which the approximate conditions of leaching are a pressure of 210 p.s.i., a temperature of 390° F., a caustic concentration of 400 grams per liter, and a digestion time of 2 to 8 hours to effect solution of the monohydrate mineral boehmite; and (2) the American Bayer, in which a pressure of about 60 p.s.i., a temperature of about 290° F., a caustic concentration of 170 grams per liter, and a digestion time of ½ to 1 hour are used to dissolve the trihydrate mineral gibbsite (*2, 18, 19*). The American process is used for treating trihydrate bauxites, because it requires less evaporation and lower temperatures and is more adaptable to continuous digestion.

In both processes the pregnant solution is separated from the red mud tailings by countercurrent decantation and filtration. The liquor is cooled until it becomes supersaturated, then seeded with crystals of aluminum trihydrate. About one-half of the alumina in solution is precipitated in a 36- to 96-hour period. The precipitate is then filtered, washed, and calcined at 2,000° F. to obtain the final product. Caustic soda is regenerated in the precipitation step and, together with the unprecipitated alumina, is recycled to the digesters. For some nonmetal uses the alumina is left in the trihydrate form or is only partly calcined.

The finely divided residue resulting from leaching contains Fe_2O_3, TiO_2, and a complex sodium aluminum silicate compound. This compound represents a loss of soda and alumina, and the quantity discarded in the residue is related to the silica content of the bauxite. Approximately 1.1 units of alumina and 1.2 units of soda are lost for each unit of silica in the ore. Bauxite must contain less than 8 percent silica for economic treatment by the Bayer process.

Approximately 4 long dry tons of bauxite is required to produce 2 short tons of alumina, which will yield upon electrolysis slightly more than 1 short ton of aluminum. The materials other than bauxite required in the Bayer process are soda ash; lime for causticizing the soda ash; and fuel oil, gas, or coal (*2*).

Crude bauxite from the mines usually is crushed to about 2-inch size in hammermills, gyratories, or jaw crushers. Free moisture, but not the water of crystallization, is removed from the ores by drying when they are to be transported considerable distances. Bauxite from Surinam and British Guiana is dried to less than 3 percent free moisture. Bauxite from Jamaica and Haiti, after drying, may still contain as much as 15 percent free moisture to prevent dusting when the ore is transported. Further treatment depends upon the end use. Ores for refractory uses are calcined in rotary kilns at 2,500° to 2,900° F. and for abrasive uses at 1,700° to 2,400° F. to remove water of crystallization.

Bauxite with more than 8 percent silica is treated by the combination process (*3*), which first became commercial as a result of the reduced supply of imported high-grade bauxite during World War II. In this process, bauxite containing 12 to 15 percent silica is first subjected to a Bayer leach. The resulting red

mud, which contains the complex sodium aluminum silicate compound, is sintered with limestone and soda ash, then leached with water to recover alumina and soda. The brown mud residue has a composition, on a dry basis, somewhat similar to that of Portland cement.

The additional cost required in capital investment, raw materials, and processing by the combination method is partly offset by higher recoveries of alumina and soda and partly by lower mining costs. A major advantage of the combination process is the decreased need for selective mining, as high-silica bauxite, previously regarded as unsuitable for alumina production, can be used. The upper limit of silica for use in this process is now about 15 percent; however, in practice, bauxite containing as high as 25 percent silica is mined and blended with low-silica ore in proportions that will give a feed material of approximately 12 to 13 percent silica. The combination process is used in the two plants in Arkansas and in plants in the U.S.S.R. and China (*21*).

In 1952 the American Bayer process was modified to treat the high-iron, low-silica bauxite of Jamaica. The major modifications resulted from difficulties in filtration of the red mud slurry and from the small amount of boehmite in the ore (*19*).

In the U.S.S.R., alumina is extracted from nephelite flotation concentrate containing about 30 percent alumina, obtained as a byproduct of apatite from deposits in the Kola Peninsula (*21*). The process used is a variation of the lime-soda sinter method, but no soda is added as it is already present in the feed.

In Norway alumina is extracted commercially from high-iron bauxites by the Pedersen smelting process. In this process, bauxite, limestone, coke, and iron ore are smelted in an electric furnace to produce pig iron and a calcium aluminate slag containing 30 to 50 percent alumina. The slag is leached with sodium carbonate solution, and the alumina trihydrate is precipitated by carbon dioxide. During World War II the process was also used at a Swedish plant to treat andalusite.

During World War II the U.S. Government erected four demonstration plants to test the following alkaline and acid processes:

1. Laramie, Wyo.—Anorthosite calcined with limestone and soda ash; sinter leached with soda solution to extract sodium aluminate; alumina trihydrate precipitated by carbon dioxide and calcined to alumina (*23*).

2. Harleyville, S.C.—Clay sintered with limestone; sinter leached with sodium carbonate solution to form sodium aluminate; alumina trihydrate precipitated by carbon dioxide and calcined to alumina.

3. Salt Lake City, Utah.—Alunite roasted, then leached with sulfuric acid solution; alumina and potassium sulfate recovered from the alum.

4. Salem, Oreg.—Calcined clay leached with ammonium bisulfate to form an alum; converted to aluminum hydroxide and calcined to alumina.

After the war the plants were shut down before the processes had been adequately tested. In 1952 to 1956 the plant at Laramie was reactivated by the Bureau of Mines and successfully operated at an output of 30 tons of alumina a day. The cost of producing alumina from anorthosite or other aluminum silicates, at the rate of 1,000 tons a day, was estimated to be one-fourth to one-half again as much as the cost of producing alumina from bauxite.

By 1956 all the Government-erected plants had been sold to industry to be used for other purposes.

USES

More than 90 percent of the alumina production is consumed by the aluminum industry. Alumina also is used for abrasive, refractory, or chemical applications in which a high degree of purity is desirable. Its minor uses include production of the nose cones of missiles, artificial sapphires, and thread guides for textile plants.

Over 90 percent of the bauxite consumed in the United States is used by 6 alumina plants and the remainder by about [illegible] abrasive, chemical, refractory, and other plants. Fused bauxite is used in bonded or coated abrasives or as abrasive grain. Since 1949 the refractory industry has used increasing quantities of bauxite as a substitute for diaspore clays. Aluminum sulfate and other aluminous chemicals are produced from bauxite for treating water and sewage, dyeing, tanning leather, and sizing paper. Bauxite is also used in the production of high-alumina cement, in low-density insulating materials, as an adsorbent or catalyst by the oil industry, and as a flux in making steel and ferroalloys.

BYPRODUCTS

Most bauxites contain small quantities of gallium and vanadium, which dissolve in the Bayer process liquors. Gallium is recovered in the United States by one company, and vanadium is recovered in a French operation. In Norway iron is produced as a byproduct of the Pedersen process. In the U.S.S.R. potash, soda, and cement are produced as byproducts in recovering alumina from nepheline syenite.

RESERVES (*3, 7, 13, 21*)

The earth's crust averages 15 percent alumina, but the commercial ore (bauxite) usually contains more than three times this proportion.

[fol. 5839]

The world bauxite reserve of 3.2 billion tons, as estimated in 1958, is shown by country in table 2. The reserve is sufficient to last 180 years at the 1958 rate of production.

The world-reserve figure has approximately doubled since 1950. Part of the increase resulted from an extension of areas under investigation. In Guinea, other parts of West Africa, Jamaica, and Australia discoveries have totaled hundreds of millions of tons.

The ability to use lower grade material has also resulted in lower cutoff grade and has been another factor in increasing estimates of reserves. As an illustration, ore used in the United States in 1930, whether of domestic or foreign origin, averaged about 60 percent alumina and 2 percent silica. By 1957 one-half the ore used in the United States contained about 50 percent alumina and at least one-fifth averaged 12 percent silica.

The United States bauxite reserve, totaling 50 million tons and averaging 52 percent Al_2O_3 and 10 percent SiO_2, is 97 percent in Arkansas and 3 percent in Georgia and Alabama.

The potential resources shown in table 2 are essentially bauxite and bauxitic clays that typically analyze 32 to 45 percent alumina. Other immense sources, not included in the table and containing less than 32 percent alumina, are nepheline syenite, anorthosite, clays, kyanite, and shales.

The United States potential resource includes bauxitic clays and bauxitic laterites. The resource of bauxitic clays, associated with the bauxite reserves in Arkansas, is estimated at 140 million tons with an average analysis of more than 35 percent alumina. Large deposits of bauxitic laterite in Oregon contain 35-percent alumina, less than 10 percent silica, and about 30 percent iron oxide.

Several hundred million tons of low-grade bauxitic laterite has been discovered in Hawaii on the islands of Kauai, Maui, and Hawaii. The Bureau of Mines and the Geological Survey have made preliminary studies to evaluate this material.

TABLE 2.—*Estimate of world bauxite reserves and potential resources, December 1958*

[Million tons]

Country	Reserves	Potential resources
North America:		
Costa Rica		80
Dominican Republic	40	40
Haiti	20	7
Jamaica	500	60
Panama		15
United States	50	320
Total	610	522
South America:		
Brazil	30	173
British Guiana	36	70
French Guiana		70
Surinam	250	208
Venezuela		10
Total	316	532
Europe:		
Austria	1	1
France	70	190
Greece	84	(1)
Hungary	250	(1)
Italy	11	12
Rumania	20	20
Spain	7	(1)
U.S.S.R.	[2] 100	(1)
Yugoslavia	125	172
Total	671	356
Asia:		
China	50	[3] 260
Federation of Malaya	15	6
India	65	152
Indonesia	15	10
Iran		15
Pakistan		9
Sarawak	5	5
Turkey	10	36
Total	148	1,220
Africa:		
Cameroons		80
Ghana	220	(1)
Guinea	600	2,400
Nyasaland		60
Total	820	2,510
Oceania:		
Australia	600	400
Pacific Islands, Ponape, Manus	3	3
Total	603	403
Grand total	3,224	5,977

[1] Not available.
[2] Includes low-grade bauxite.
[3] Principally diaspore.

Source: United States Geological Survey.

SOURCES OF STATISTICAL INFORMATION

Statistical information on stocks and production of alumina and shipments of alumina classified by recipient industry are collected annually by the Bureau of Mines. The Bureau also collects data on the consumption of alumina by the aluminum industry.

Statistical information on domestic bauxite is collected and published periodically by the Bureau of Mines and the Bureau of the Census. Other sources of information include special studies presented in the technical press, reports of aluminum producers and investment companies, and reports by other agencies such as the Federal or State Geological Surveys. The Bureau of Mines publishes quarterly reports and a comprehensive annual report.

Information on foreign bauxite consumption is almost wholly lacking, and data on alumina production and trade in foreign countries are incomplete.

PRODUCTION, CONSUMPTION, AND FOREIGN TRADE

Table 3 shows domestic alumina production and shipments to consuming industries by producers. From 1954 through 1958, shipments to the aluminum industry represented 95 percent of the total shipments. Before 1958, United States foreign trade in alumina was relatively small.

Table 3.—*Production and shipments of alumina in the United States, calcined equivalent*

[Thousand short tons]

Year	Production	Shipments: For aluminum	Shipments: For other	Shipments: Total
1949-53 (average)	1,812	[1] 1,[illegible]	(2)	(2)
1954	2,985	2,811	115	2,926
1955	3,197	3,012	138	3,150
1956	3,464	3,245	164	3,409
1957	3,442	3,222	179	3,401
1958	2,188	2,985	147	2,132

[1] Consumption 1949-52; shipments 1953.
[2] Not available.

United States production, imports, and consumption of bauxite are shown in tables 4 and 5 and world production in table 6.

Exports of bauxite, 1949 to 1958, inclusive, ranged from 18,000 to 139,000 tons, averaging about 56,000 tons. The principal recipient was Canada, and part of the export was returned to the United States in the form of abrasives.

SELF-SUFFICIENCY

Before 1958 practically all the United States alumina requirements were met by domestic production. However, in 1958 one company with requirements of slightly more than 100,000 tons per year, representing 3 percent of United States needs, began importing alumina from Japan.

Table 4 shows United States self-sufficiency in bauxite for recent years. Since about 1920 there has been a declining trend in self-sufficiency, and by 1958 domestic production accounted for only 14 percent of the total new supply. The domestic reserve of bauxite is sufficient to maintain an annual production of approximately 1.5 million tons for several decades; any increase in demand must be supplied by imports.

Table 4.—*United States supply and self-sufficiency of bauxite*

[Thousand long tons]

Year	Domestic production (dry basis)	Imports (crude and dried) [1]: Jamaica	Surinam	British Guiana	Other [2]	Total	Percent self-sufficiency
1949-53 (average)	1,516	[3] 923	2,482	120	292	3,817	30
1954	1,365	1,717	3,095	175		4,988	28
1955	1,788	2,178	2,602	242		4,982	27
1956	1,744	2,573	2,795	259	20	5,670	24
1957	1,426	2,672	2,707	301	319	7,099	17
1958	1,311	4,983	2,125	225	230	7,919	14

[1] Only small quantities of undried bauxite were imported.
[2] In 1949-53 Indonesia, in 1956 Guinea, and in 1957 and 1958 Haiti, were the principal other sources.
[3] Average for 2 years only, as 1952 was the first year of commercial production.

Table 5.—*United States consumption of bauxite by industries*

[Thousand long tons, dry basis]

	1949-53 (average)	1954	1955	1956	1957	1958: Quantity	1958: Percent
Alumina	2,448	4,845	6,288	7,140	6,986	6,311	92.6
Abrasive	302	225	286	277	318	185	2.6
Refractory		66	64	84	82	60	.9
Chemical	160	100	182	169	199	220	3.1
Other	51	52	59	61	66	58	.8
Total	2,951	5,428	6,989	7,751	7,653	7,094	100.0
Bauxite consumed in aluminum production ... percent	79.1	84.3	85.6	85.1	83.4	87.8	

TABLE 6.—*World production of bauxite*

[Thousand long tons]

Country	1949-53 (average)	1954	1955	1956	1957	1958
Jamaica [1]	[2] 767	2,044	2,645	3,141	4,649	5,722
Surinam	2,425	[illegible]	2,974	[illegible]	[illegible]	3,341
U.S.S.R. [3]	545	1,200	1,600	2,100	2,410	2,750
France	807	1,307	1,470	1,642	1,607	[illegible]
British Guiana	2,011	2,310	[illegible]	2,451	[illegible]	[illegible]
United States [1]	1,516	[illegible]	1,780	1,744	1,416	1,211
Hungary	524	1,240	1,228	570	[illegible]	[illegible]
Greece	175	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yugoslavia	422	570	775	[illegible]	674	[illegible]
Indonesia	311	171	[illegible]	[illegible]	[illegible]	[illegible]
Guinea	90	[illegible]	[illegible]	444	[illegible]	[illegible]
Italy	191	[illegible]	[illegible]	271	[illegible]	[illegible]
Brazil [1]					[illegible]	[illegible]
Malaya	[illegible]	166	[illegible]	[illegible]	[illegible]	[illegible]
Ghana (exports)	116	164	115	138	[illegible]	[illegible]
[illegible]						[illegible]
India	[illegible]	73	81	91	97	115
Other countries [4]	60	76	101	126	120	136
World total (estimate)	11,120	15,600	17,600	18,500	20,100	20,700

[1] Dry equivalent of crude ore.
[2] Average for 1952-53.
[3] Estimate.
[4] Includes estimate for Rumania.

Surinam, Jamaican, and Refractory grade bauxites and crude aluminum oxide abrasives are in group I of the list of strategic and critical materials for stockpiling. Government stocks have been acquired, and at the end of 1958 the status of the inventories was as follows:

1. Surinam—quantity acquired substantially equals or exceeds the basic objective.
2. Jamaica—quantity on hand is sufficient to complete the basic and maximum objectives.
3. Refractory—quantity acquired substantially equals or exceeds the basic and maximum objectives.
4. Crude aluminum oxide—quantity acquired substantially equals or exceeds the basic and maximum objectives.

Abrasive-grade bauxite is listed in group II, and in 1958 none was under procurement.

DEFENSE PROGRAM

In order to meet the requirements of the aluminum industry, alumina plants were built by the Government during World War II. The construction of alumina plants was encouraged during the Korean hostilities through issuance of accelerated tax amortization certificates and guaranteed market contracts for aluminum.

During World War II, the bauxite reserve in the United States was more than doubled as a result of an extensive exploration program undertaken by the Federal government and industry. Other government programs assisted the sharp expansion in domestic bauxite production from less than 0.5 million tons in 1940 to an alltime high of 6.2 million tons in 1943. During the Korean hostilities, bauxite mining operations in Jamaica and Surinam were increased with government assistance.

PRICES AND COSTS

The cost of alumina at reduction plants in 1949 was reported as 3.48 to 3.65 cents a pound of aluminum (*12*). Since an average of 1.91 pounds of alumina is required to produce 1 pound of aluminum, the cost of alumina was about $36 to $39 a ton. The value of shipments of alumina and bauxite, as reported by producers, is shown in table 7.

The price of bauxite sold on the open market is largely based on alumina content and impurities present. As most bauxite is either consumed by the mining companies and their affiliates or purchased under long-term contracts, average quoted prices are not a reflection of a strongly competitive market but are largely nominal.

TABLE 7.—*Average values of bauxite and calcined alumina*

Year	Bauxite, per long dry ton		Calcined alumina per short ton [3]
	Domestic [1]	Imported [2]	
1949-53 (average)	$5.75	8.63	[4] $62.75
1954	5.27	7.26	57.00
1955	5.12	7.51	[illegible]
1956	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]

[1] Average value of mine production.
[2] At port of shipment, as reported to the Bureau of the Census.
[3] Average value of shipments.
[4] 1953 only.

TAXES AND TARIFFS

A State severance tax of $0.10 per short wet ton is levied on bauxite mined in Arkansas. Bauxite produced in Jamaica is subjected to royalties and taxes totaling about $2, and in Surinam these total about $2.50 per long dry

ton. Domestic producers are granted a depletion allowance of 23 percent on income from domestic production and 15 percent on income from foreign production.

United States duties of 0.25 cent per pound of alumina used for producing aluminum, $0.50 per long ton on crude and dried bauxite, $1 per ton on calcined bauxite used for refractories, and 15 percent ad valorem on calcined bauxite for other uses were suspended for a 2-year period until July 16, 1960. The 0.25 cent per pound duty on alumina or aluminum hydroxide imported for other uses was not suspended.

TRANSPORTATION

Alumina produced in the South Central United States is transported usually in trainload lots, to the reduction plants. Freight to the Pacific Northwest is about $12 a short ton. Alumina is also transported by barge up the Mississippi River. The free-flowing properties of dry alumina are utilized when loading or unloading by hopper, conveyor, or pneumatic methods.

Approximately 60 percent of the world bauxite supply is produced in the tropics. The aluminum content of most of this ore is transported considerable distances in the form of ore, alumina, or metal to the principal markets in the North Temperate Zone.

Methods of transporting bauxite have been improved through development of such equipment as 35-ton trucks with heated bottoms to minimize sticking, aluminum gondolas, and ships and piers that are designed to make the greatest possible use of belt conveyors for loading and unloading. New shallow draft ships, which can navigate the Surinam rivers with a full load, do not require a stop at Trinidad to top off the cargo.

RESEARCH

During World War II an extensive research program aimed at developing methods for recovering alumina from low-grade ores was undertaken by the Bureau of Mines. Methods for upgrading low-grade bauxites (those with high-silica and/or high-iron content) were investigated. Acid and alkaline processes for extracting alumina were tested and the most promising methods investigated on a pilot-plant scale. During this period other Government and private organizations conducted research on similar processes.

Current Bureau of Mines research includes a fundamental study of the reactions in the alkaline sinter process, an evaluation of acid and alkaline processes to serve as a guide for further research, and a study of methods for upgrading Arkansas bauxites and recovering the alumina from Hawaiian bauxite and Oregon laterite. Research on mining techniques is underway in Arkansas.

All six companies producing aluminum have laboratories in which research is in progress on improving present processes for recovering alumina or developing methods for recovering alumina from noncommercial materials. Anaconda Aluminum Co. has built a 50-ton-per-day pilot plant for testing an acid process for recovering alumina from Idaho clays. North American Coal Corp. and Strategic Materials Corp. are investigating, jointly, an acid process for recovering alumina from low-grade ores and coal-mine wastes. In addition, studies at some laboratories are directed toward expanding the use of alumina by the refractory, abrasive, petroleum, and other industries.

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PLAINTIFF'S EXHIBIT 421b

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
preprinted from BULLETIN 585

ALUMINUM

BY R. A. HEINDL

a chapter from

MINERAL FACTS AND PROBLEMS, 1960 EDITION

1910

THE BUREAU OF MINES 50TH ANNIVERSARY

1960

[fol. 5844]

UNITED STATES DEPARTMENT OF THE INTERIOR • Fred A. Seaton, Secretary

BUREAU OF MINES • Marling J. Ankeny, Director

This publication is a chapter from Bulletin 585, MINERAL FACTS AND PROBLEMS, 1960 edition. The complete volume, covering all mineral commodities, may be purchased from the Superintendent of Documents, Washington 25, D.C., at a date to be announced later.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. - Price 15 cents

ALUMINUM[1]

By R. A. Heindl[2]

NAPOLEON III had tableware made of aluminum but he also recognized that such a light metal had military potential and through financial assistance encouraged experimental research on its production. Today tableware and military applications represent only a small part of the total aluminum consumption.

SUMMARY

The discovery of a commercial process for the electrolytic recovery of aluminum, late in the 19th century, opened a new chapter in the world's industrial history. Growth of the primary aluminum industry in the United States has been so rapid that the quantity produced annually now exceeds that of any other nonferrous metal. Since 1955 aluminum production in the United States has exceeded 1.5 million tons annually. Aluminum is of great importance in the aircraft industry, and efficient, competitive operation of many other industries requires a continued supply of the light metal.

The basic process for producing aluminum, developed independently by Hall and Héroult nearly 75 years ago, is by electrolysis of high-purity aluminum oxide in a bath of molten cryolite. Research in reduction cell design and development of larger cells has led to economies in power and manpower requirements. There has been much research on other processes for recovery of the metal, but none has proved more economical.

Except for a few years immediately before World War II the United States has been the world's leading producer of aluminum and accounted for more than 40 percent of world output in 1958. The output of Canada, the second largest producer, represented an additional 17 percent of the total. The capacity of the domestic primary industry has always been nearly equal to demand. For the past 10 years U. S. imports have accounted for an average of 12 percent of the total supply of crude and scrap aluminum; and 81 percent of the bauxite used in 1958 was imported.

The recovery of secondary aluminum, from 1954 to 1958, averaged 16 percent of the apparent consumption of primary and secondary aluminum. New scrap is the source of nearly 80 percent of the secondary metal recovered.

The primary aluminum industry expanded sharply under the impetus of World War II and the Korean hostilities—partly with the aid of Government funds and incentives. In 1940 there was one domestic primary aluminum producer, by 1958 there were six, three of which were completely integrated from the mine to aluminum fabricating plants. Much of the primary production is consumed in semifabricating plants owned by the producers.

Since approximately 20 percent of the cost of aluminum is electric energy, the aluminum industry, has until relatively recent times, built plants near sources of low-cost hydroelectric power. However, since World War II, demand for power in industrially developed countries has increased sharply and competing industries can pay more than the aluminum industry for power. The domestic aluminum industry turned first to hydroelectric power, second to natural gas, then to lignite, and in 1957 new aluminum smelters were built near large coal deposits. Aluminum producers in many foreign countries have constructed plants in relatively isolated and thinly populated areas where hydroelectric power could be made available.

The progressive research, development, and sales policies of the aluminum producers have resulted in the displacement of many materials from their historical market by aluminum. The relatively stable price of aluminum has been an important factor in the increased usage of the metal. Industries which consume major quantities of aluminum are: Building and construction, transportation, consumer durables, containers and packaging, electrical equipment, and machinery and equipment. As applications for aluminum are developed and current markets are expanded, production and

[1] Italicized numbers in parentheses refer to items in the bibliography at the end of this chapter. Alumina, bauxite, and the recovery of alumina from nonbauxitic raw materials are discussed in the Alumina and Bauxite Chapter.

[2] Assistant chief, Branch of Light Metals.

consumption of this versatile metal are expected to continue to expand at a greater rate than the national economy.

Maintenance of an adequate aluminum supply requires assured sources of alumina and electrical energy. Continuation of research on reactions in the electrolytic cell may result in a decrease in power and manpower requirements. Alloy and product research will lead to the development of new uses, such as automobile engine blocks, which would consume large quantities of aluminum.

BACKGROUND

Recognizing that alumina was the oxide of a metal, Sir Humphry Davy, in 1808, named the metal "alumium" which he later change to "aluminum." Later the spelling "aluminium" came into general use and is still used in many countries. In the United States the simpler spelling "aluminum" was adopted.

Davy's attempts to isolate the metal were unsuccessful, but in 1825 Hans Christian Oersted produced aluminum by treating aluminum chloride with potassium amalgam. Frederick Woehler, some years later, produced an impure powdered aluminum using potassium as the reducing agent. Henri Ste. Claire Deville, in France, using sodium metal as the reducing agent, produced the first commercial quantities of aluminum in 1854. Although much research was done on lowering the cost of the sodium, aluminum was never produced by this method at a price competitive with other nonferrous metals. In 1857 aluminum was $27 a pound and the price was reduced to $17 by 1859.

In 1885 less than 300 pounds of aluminum was produced in the United States, but the discovery of an electrolytic process in 1886 by Charles Martin Hall in the United States and independently by Paul Héroult in France opened the way for a new industry. Using this new process, by 1895 production had increased to ~~900,000 pounds and prices~~ had decreased from $10 to $0.59 a pound. Now, nearly 75 years following the discovery of the process, equipment has undergone considerable change and refinement, but the Hall-Héroult electrolytic process still is used. In 1958, when primary aluminum production was more than 1.5 million tons, the price of ingot averaged 26.9 cents a pound.

Beginning in 1954 and continuing through 1958, production of primary aluminum in the United States has exceeded that of any other nonferrous metal. The United States has been the world's leading aluminum producer except during the pre-World War II period, 1934 to 1940, when for 5 years Germany was the leading producer. Since 1942 Canada has been the second largest producer. Estimates for 1958 indicate that production in the U.S.S.R. is approaching that of Canada.

The Aluminum Company of America (Alcoa), owning bauxite, alumina, and aluminum producing facilities, was the only domestic producer from 1886 to 1940.

SIZE AND ORGANIZATION OF INDUSTRY

At the end of 1958 the primary aluminum industry was composed of six companies. Three of these companies, representing more than 85 percent of the U. S. productive capacity, were vertically integrated from mining through production of semifabricated shapes.

Figure 1 illustrates the organization of the domestic industry and shows plant locations, capacity, and plants under construction at the ~~end of 1958. Table 1 summarizes this information.~~

TABLE 1.—*Primary aluminum productive capacity by companies, Dec. 31, 1958*

Company	Number of aluminum reduction plants	Annual capacity, thousand tons	Percent of total
Aluminum Company of America (Alcoa)	7	798	36.4
Reynolds Metals Co.	6	601	27.4
Kaiser Aluminum & Chemical Corp.	4	537	24.5
Anaconda Aluminum Co.	1	60	2.7
Harvey Aluminum, Inc.	1	54	2.5
Ormet Corp.	1	144	6.5
Total	20	2,194	100.0

Harvey Aluminum, Inc. and Ormet Corp. (a subsidiary of Olin Mathieson Chemical Corp. and Revere Copper and Brass, Inc.) produced primary metal for the first time in 1958, but Harvey, Olin, and Revere produced semifabricated shapes from purchased ingot prior to that year.

At the end of 1958 the world capacity to produce primary aluminum, shown in table 2, was estimated as 4.9 million short tons.

TABLE 2.—*World primary aluminum productive capacity*

Country or continent	Annual capacity: Thousand tons	Annual capacity: Percent of total
United States	2,194	48.2
Canada	865	17.8
Europe	767	15.8
Asia	106	2.2
U.S.S.R. and Iron Curtain countries	845	17.4
Others, including South America, Africa, and Australia	76	1.6
Total	4,554	100.0

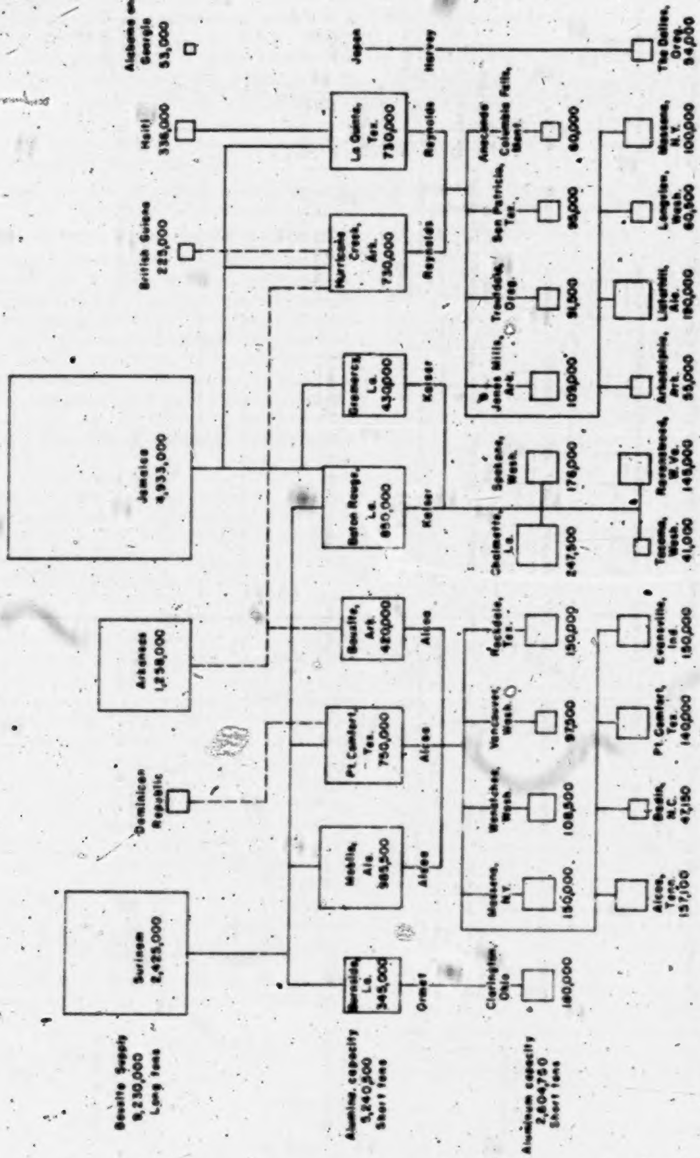

FIGURE 1.—Bauxite Supply and Alumina- and Aluminum-Plant Capacities in the United States in 195[illegible] (includes plants under construction).

GEOGRAPHIC DISTRIBUTION OF THE INDUSTRY

The aluminum reduction industry is a major consumer of electric power and uses approximately 3 percent of the domestic electric power generated. In order to maintain its competitive position, large quantities of low cost dependable electrical energy are a necessity for this industry. Before 1950 plants were built near sources of low-cost hydroelectric power such as the Niagara Falls area, the Tennessee Valley area, and the lower Columbia River area of the Pacific Northwest. However, aluminum consuming and other industries entered these areas, and in some instances the cost of power from new facilities was increased. Since 1950, in addition to situating plants in the limited number of places where new hydropower supplies became available, the industry has built several large plants where natural gas, lignite, or bituminous coal for thermally generated electric power are available. New plants in the Ohio River Valley are near the markets and can take advantage of lower water freight rates (*9, 11*).

As indicated by figure 1, alumina, the basic raw material for the primary aluminum smelters, is produced in the South Central United States in Arkansas, Texas, Louisiana, and Alabama. The reduction plants are more widely dispersed. See table 3.

TABLE 3.—*Geographic distribution of aluminum reduction plants*

Location	Number of aluminum reduction plants	Annual capacity, thousand tons	Percent of total
Pacific Northwest	6	690	31
New York, Ohio, and West Virginia	5	335	15
Arkansas and Louisiana	3	411	19
Alabama, Tennessee, and North Carolina	3	394	18
Texas	3	365	17
Total	20	2,194	100

Completion of new facilities under construction in 1959 will result in new capacity in Indiana and increased capacity in New York, Ohio, Texas, and West Virginia.

DEFINITION OF TERMS, GRADES, AND SPECIFICATIONS

Pig.—Metal as initially produced by a primary reduction plant, taken directly from the reduction cell and cast into a convenient form. Pig is cast in a wide variety of sizes but the usual commercial size is 50 pounds, with a 99.5 percent guaranteed minimum aluminum content.

Ingot.—A cast form suitable for working or remelting that has been poured from either a melting or alloy furnace. The common commercial size is 30 pounds and the aluminum content is 99.5 plus percent.

Potline.—A number of reduction cells or pots, usually 100 to 150, connected in electrical series.

Super-purity aluminum.—Contains a minimum of 99.99 percent aluminum.

Aluminum Alloys.—Generally divided into two major groups: Wrought and casting. Table 4 gives the chemical composition for two alloys of each type. Unalloyed metal usually contains 99.5 percent aluminum and small quantities of iron and silicon. Even when no alloying elements have been added, the quantity of impurities present has to be controlled carefully. Metal with over 99.5 and up to 99.85 percent aluminum is available at costs up to 3 cents per pound more than standard commercial metal. It is used where superior electrical conductivity or corrosion resistance is required. Purities higher than 99.85 percent are necessary for certain applications.

There are several acceptable methods of designating aluminum alloys. However, a 4-digit code for wrought alloys was adopted by The Aluminum Association in October 1954. The first digit indicates the major alloying ingredient. If the first digit is 1 the alloy has

TABLE 4.—*Chemical analysis of some aluminum alloys, in percent* [1]

Type and number	Cu	Fe	Si	Mn	Mg	Zn	Ti	Cr	Other elements: Each	Other elements: Total
Wrought 1100 [2, 3]	0.20	Fe+Si 1.0		0.05	-------	0.10	-------	-------	0.05	0.15
Wrought 2024 [4]	3.8–4.9	0.50	0.50	0.30–0.9	1.2–1.8	0.25	-------	0.10	0.05	0.15
Casting 43	0.10	0.8	4.5–6.0	0.30	0.05	0.20	0.20	-------	0.05	0.15
Casting 108	3.5–4.5	1.0	2.5–3.5	0.30	0.03	0.20	0.20	-------		0.[illegible]0

[1] Values are maximum unless shown as a range; aluminum is remainder.
[2] Aluminum minimum—99.00 percent.
[3] Replaces commercial designation 2S.
[4] Replaces commercial designation 24S.

a minimum aluminum content of 99.00 percent. Digits 2 to 8 in the first position designate copper, manganese, silicon, magnesium and silicon, zinc, and other element, respectively; 9 is an unused series.

If the alloy has a minimum aluminum content of 99.00 percent; the second digit indicates special control on impurities and the last two digits indicate the minimum aluminum content figures to the right of the decimal point. Thus, 1030 indicates 99.30 percent minimum aluminum content without special control on individual impurities.

When the first digit is 2 through 8, indicating a major alloying ingredient, the second digit indicates alloying modifications and the last two digits identify the alloy, usually by the commercial code number previously used to designate the same alloy. Thus, 2014, formerly alloy 14S, contains copper as the major alloying ingredient with no alloy modification.

Additional letters, O and F, and letters H and T with numbers, may follow the alloy digits and designate the temper of the alloy.

No uniform system has been adopted by the industry for designating casting alloys. These alloys may be designated by American Society for Testing Materials numbers, U.S. Federal Specifications, Society of Automotive Engineers, commercial, and individual company symbols.

TECHNOLOGY

PRIMARY ALUMINUM (*16, 17, 19*)

Primary aluminum is produced exclusively by the electrolysis of alumina in a molten cryolite bath. Purity of the alumina used must be greater than 99.0 percent. The electrolytic reduction cell consists of a carbon-lined box containing a pad of molten aluminum which serves as the cathode, a carbon anode, and an electrolyte of molten cryolite in which the alumina is dissolved. Small quantities of aluminum fluoride are used in the electrolyte to combine with Na_2O, an impurity in alumina, to form artificial cryolite, and the melting point of the bath is lowered by the addition of small quantities of fluorspar. The anode may be either one large block of carbon or a number of small blocks of carbon. The alumina is reduced to aluminum at the cathode, and carbon is oxidized to carbon dioxide at the anode. The overall reaction may be written:

$$Al_2O_3 + 2C \rightarrow 2Al + CO_2 + CO$$

The carbon lining, which contains the molten aluminum, is built into a steel shell. Typical dimensions of the shell are 20 feet long, 10 feet wide, and 3 feet deep. It is lined first with refractory insulation. The insulation is then lined with carbon blocks, joined by carbon cement, or a monolithic lining is prepared by baking carbon paste in place. The carbon lining usually must be replaced after 3 to 4 years.

The carbon anodes are consumed at a rate of about 1 inch of vertical length per 24 hours of operation and the method of replacement is important in regard to overall costs. There are two methods of replacing anode carbon through: (1) Soderberg continuous anodes and (2) prebaked anodes.

In the Soderberg anode a reinforced rectangular steel shell, open at the top and bottom, is suspended above the furnace. Carbon paste or briquets of coke and pitch are added periodically as the anode is consumed. Current enters the anode through rows of pins inserted into the carbon mass either vertically or horizontally. The heat of the bath and the heat resulting from the electrical resistance of the carbon bake the paste or melt and bake the briquets so that at a point approximately 20 inches above the bath the carbon becomes a hard monolithic mass. The steel pins, in addition to conducting current, support the carbon mass. As the carbon descends through the hopper and is consumed, the lowest pins are periodically withdrawn and replaced at higher levels in the anode box. The optimum anode-cathode distance is maintained by raising or lowering, simultaneously, the pins which are baked into the lower part of the carbon block. Inasmuch as the pad of molten metal builds up at approximately the same rate as the anode is consumed this adjustment is usually made only when metal is withdrawn from the cell.

In the prebaked anode system sets of 16 to 24 prebaked carbon blocks are used. The size of the blocks varies from plant to plant; in one plant the blocks are 20 inches wide, 31 inches long, 12 inches high, and weigh about 400 pounds. The blocks are supported in the bath by steel stubs or rods which conduct the current to the carbon. These stubs are inserted into a hole in the top of the finished block and anchored in place by casting molten iron around the stub. The blocks are raised or lowered separately to maintain proper position with respect to the bath and are replaced individually as they are consumed (*7*).

The Soderberg system requires less labor and, with the exception of moving the steel pins, is a continuous method of feeding anode carbon. The prebaked system results in better electrical efficiency in the reduction cell but requires fabricating and rodding facilities not used in the Soderberg system.

The molten bath or electrolyte may be as deep as 14 inches, but the anode is usually only 2 inches from the pad of molten aluminum. The resistance of the bath is sufficient to maintain an optimum operating temperature of

950° to 1,000° C. At this temperature the alumina dissolved in the bath varies from 6 to 10 percent. When the alumina concentration drops to 2 percent, the electrical resistance of the cell increases sharply and the voltage drop across the cell increases from 5 volts to 30 or 40 volts. The phenomenon is known as the "anode effect." As soon as this condition occurs, the crust of frozen cryolite on top of the bath is broken and more alumina is added to the cell which then returns to normal operating condition.

Every 1 to 3 days the molten aluminum is removed from the cell by aspiration. Cast iron pots with airtight lids and downward sloping spouts are used. The molten metal is blended with other batches and then may be fluxed, alloyed, cast, or if the fabricating facility is nearby, transported molten to the fabricating plant.

Plants constructed since 1950 have much larger cells than were used in older plants. These cells utilize currents from 65,000 to 125,000 amperes, with the majority of plants having 80,000- to 100,000-ampere cells. The voltage drop across a single cell is 4.5 to 5.0 volts and across a potline 600 to 800 volts.

The larger cells require less manpower per pound of aluminum produced, but special problems are encountered in cells designed to use 100,000 and more amperes. The large currents cause powerful magnetic fields in the metal and bath, resulting in violent agitation. This agitation causes a fog of aluminum to be dispersed in the bath which increases the possibility of reversing the reduction reaction. Another detrimental effect is that the molten metal piles up toward the negative leads causing a variation in the anode-cathode spacing. Moveover, localized thermal effects may distort the carbon lining (*4*).

Current efficiency varies from 85 to 90 percent; losses are principally due to physical losses of metal and reoxidation of aluminum by carbon dioxide. Owing to the electrical resistance the voltage efficiency is only 40 percent with heat being lost by radiation, and in the exhaust gases, in tapped metal, and in electrodes removed from the cell. As a result the overall energy efficiency is about 35 percent. About 7.5 to 8.5 kw.-hr. is required in the cell per pound of aluminum metal produced. Total plant requirements are less than 10 kw.-hr. per pound.

Table 5 summarizes the raw materials used in producing one pound of aluminum.

To prevent pollution of the atmosphere, gases from the cells are passed through a collection system which removes alumina, carbon, and fluorides.

TABLE 5.—*Raw materials and energy required to produce one pound of aluminum*

	Unit	Quantity
Alumina	Pound	1.93
Cryolite	do	0.02–0.03
Aluminum fluoride	do	0.02–0.03
Fluorspar	do	0.003
Anode carbon	do	0.55
Cathode carbon	do	0.02
Electrical energy	Kilowatt-hour.	7.5–8.5

The relatively low tensile strength of commercially pure aluminum limits its use in heavy durable products. However, by alloying, cold rolling, or heat treating, aluminum alloys with strengths approaching those of mild steels have been developed. There are more than 100 commercially-available aluminum alloys and several new alloys usually are developed each year. The alloys offers a wide variety of combinations of mechanical strength, ductility, electrical conductivity, and corrosion resistance. A small addition of manganese increases the strength of wrought aluminimum. Magnesium and silicon, together or separately, give aluminum alloys with good corrosion-resistance and strengths. Copper and zinc are used to produce alloys with high strength-to-weight ratios. Small quantities of other metals such as nickel, chromium, titanium, and tin are sometimes added for grain refinement or to impart special characteristics.

The production of super-purity aluminum requires a second electrolytic step in which a cell, known as the Hoopes cell, with three molten layers is used. The bottom layer is the anode, a relatively impure aluminum alloyed with copper to increase its density. The intermediate layer in the conventional Hoopes cell is molten cryolite with barium fluoride added to give it a density greater than that of pure aluminum. The top layer, which serves as the cathode, is molten super-purity aluminum.

Direct smelting of aluminum-silicon alloys from clay has been investigated. High-purity clay is used to minimize contamination of the alloy by iron and titanium. An electric furnace with graphite electrodes has been used with a carbon reductant, which may be coke, charcoal, sawdust, hogged fuel, or mixtures of these materials. At operating temperatures pure aluminum would volatilize or react with oxides of carbon. This is prevented by the addition of silicon which alloys with the aluminum and promotes absorption of the aluminum vapors (*3*).

Methods for recovering commercial grade aluminum from Al-Si alloys have been investigated. Experimental procedures have included

leaching the alloy with a molten metal such as zinc in which the aluminum dissolves and the silicon and impurities are relatively insoluble. The zinc is then distilled from the dissolved aluminum. In the subhalide process a crude aluminum alloy is treated with $AlCl_3$ at approximately 1,000° C. to produce AlCl. The reaction is reversed by lowering the temperature; pure aluminum condenses and the $AlCl_3$ vapors are recycled.

Many other methods of recovering aluminum have been proposed (*8, 16*). Such processes include the treatment of alumina with aluminum sulfide and carbon at an elevated temperature; hydrogen reduction of alumina at pressures above 100 atmospheres and temperatures above 400° C.; reaction between alumina and aluminum carbide at 1,980° C.; and electrolytic reduction of complex alumino-organic compounds such as $NaF.2Al(C_2H_5)_3$.

SECONDARY ALUMINUM *(2, 15)*

Much aluminum scrap is processed into secondary aluminum ingot without preliminary treatment. New scrap requires little or no sorting, and manual sorting of old scrap is too expensive to be widely practiced. Scrap in the form of borings and turnings is dried and the oil removed by burning. Tramp iron is removed by magnetic separators. Dross and foil also usually require treatment before being melted. From 40 to 95 percent of the scrap is recovered as metal. Low recoveries are obtained from drosses and skimmings; high recoveries from segregated sheet and clips.

Most scrap is melted in 5- to 25-ton capacity reverberatory furnaces operated on a 24-hour cycle. Important advantages of this type of furnace are its ease of mechanical charging, low flux consumption, and a melt loss of only 2 to 5 percent. The molten aluminum is protected from surface air oxidation by a layer of flux, which usually contains sodium chloride, potassium chloride, and cryolite. Other salts which may be included are calcium chloride and sodium fluoride. The melt may be refined by passing chlorine gas through the molten metal or by using reactive salts such as aluminum fluoride or soduim silicofluoride in the flux. Nitrogen is introduced to degas the melt and bring the dross and oxides to the surface.

Some scrap processing plants have dust- and fume-collecting equipment. Electrostatic precipitators and Venturi scrubbers apparently are effective in removing volatile alkali chlorides and fluorides as well as particles of aluminum, magnesium, and silicon from the exhaust gases. In small, intermittent operations, furnaces may be in the open or poorly hooded and therefore can be contributors to air pollution (*1*).

Secondary smelters consuming aluminum scrap produce specification wrought and casting alloys. Casting alloys account for most of their production. Once the scrap has been melted alloying ingredients or primary aluminum are added to bring the melt to specification.

USES *(5)*

Aluminum is used in many products because of its low density, high electrical or thermal conductivity, resistance to corrosion, low neutron absorption cross-section, nontoxicity, malleability, reflectivity, nonmagnetic and nonsparking properties, or high strength-to-weight ratio. In many applications aluminum is in direct competition with copper, steel, magnesium, lead, wood, plastics, rock wool, or fiberglass.

Shipments of aluminum are usually divided into three major categories: (1) Wrought products, such as rolled, extruded and forged shapes, (2) cast products, and (3) products for dissipative uses in which the metal loses its identity as in its use as an alloying ingredient in nonaluminum base alloys, a deoxidizer in the production of steel, or in the production of aluminum chemicals. Net shipments, classified as wrought or cast products, are shown in table 6. In addition, nearly 325,000 tons of ingot was shipped to Government stocks in each year 1957 and 1958, and it is estimated that 100,000 tons has been consumed annually in dissipative uses.

More than 25 percent of the aluminum consumed domestically is used for construction in such items as siding, roofing, curtain walls, flashing, insulation, windows and screening, and builders' hardware.

The transportation industry is also a major consumer of aluminum accounting for more than 20 percent of total consumption. The high strength-to-weight ratio of aluminum makes it valuable in any carrier, but this factor has been most important in aircraft. In buses and truck trailers it often accounts for 15 to 40 percent of the total weight of the vehicle. Since 1945, railroad equipment manufacturers have greatly increased their use of aluminum for trim and accessories. A few "all aluminum" passenger and freight cars have been built.

During the 1920 decade a number of automobiles used large quantities of aluminum, but the price and supply of aluminum were such that as automobile production increased and steel technology improved, the use of aluminum in automobiles gradually decreased until 1946 when only about 7 pounds of aluminum were used per automobile. Since then, this decreasing trend has been reversed. In 1955 an

TABLE 6.—*Net shipments of aluminum wrought and cast products by producers*

[Short tons]

(Bureau of the Census)

	1949–53 (average)	1954	1955	1956	1957	1958
Wrought products:						
Plate, sheet, and strip	548, 039	582, 538	771, 362	784, 059	698, 251	676, 517
Rolled structural shapes, rod, bar, and wire	168, 419	180, 641	183, 976	210, 600	199, 548	172, 917
Extruded shapes, tube bloom, and tubing	152, 048	256, 650	387, 546	396, 202	394, 787	410, 836
Powder, flake, and paste	15, 440	23, 452	17, 840	14, 210	14, 094	12, 814
Forgings			35, 172	37, 833	32, 132	25, 352
Total	883, 946	1, 043, 281	1, 395, 896	1, 442, 904	1, 338, 812	1, 298, 436
Castings:						
Sand	90, 993	78, 277	82, 741	85, 890	71, 996	58, 719
Permanent mold	81, 181	107, 204	149, 174	122, 711	116, 163	92, 800
Die	82, 607	122, 645	177, 602	188, 115	186, 793	146, 300
Other	3, 919	3, 401	(1)	(1)	(1)	(1)
Total	258, 700	311, 527	410, 396	397, 291	375, 909	298, 228
Grand total	1, 142, 646	1, 354, 808	1, 806, 288	1, 840, 195	1, 714, 721	1, 596, 664

[1] Withheld because estimates did not meet publication standards of the Bureau of the Census owing to the associated standard error.

average of 30 pounds per car was used and the 1959 models contain an average of 57 pounds of aluminum per car. Major aluminum components in automobiles are pistons, automatic transmission parts, and trim. One automobile manufacturer in the United States late in 1959 began producing a car powered by an engine made largely from aluminum.

Only in the past 25 years have marine applications of aluminum become important. During this period alloys with high mechanical strength and high corrosion resistance have been developed, and the problem of bimetallic corrosion has been largely eliminated by proper insulation. Approximately 2,000 tons of aluminum was used in the superstructure, decks and deckhouses, stack enclosures, bulkheads, and lifeboats of the SS United States. Many small pleasure craft are fabricated almost entirely from aluminum.

More than 15 percent of the total quantity of aluminum consumed goes into consumer durable goods including refrigerators, air conditioners, washing machines, furniture, utensils, and small appliances.

Ten percent of the aluminum consumed is used in the electrical and communications industries. In most instances aluminum cable with steel reinforcing has displaced copper for cross country transmission lines. It is estimated that aluminum conductors account for 90 percent of all new transmission lines in the United States. Aluminum conductor is also used in urban distribution lines and service drops.

Aluminum containers and packaging including foil, caps and closures, and collapsible tubes account for nearly 10 percent of total aluminum consumption.

Its use in machinery and equipment, in the chemical and metallurgical industry, and miscellaneous uses consume approximately 20 percent of the total aluminum supply.

Super-purity aluminum has a number of applications including its use as a catalyst for producing high octane gasoline, as an electrical capacitor foil, and in consumer products such as automobile and appliance trim and costume jewelry.

SUBSTITUTES

Aluminum has replaced many materials that can now be considered as substitutes for aluminum. If aluminum supplies were curtailed, or the price increased, steel and stainless steel, magnesium, zinc, titanium, lead, copper, plastics, fiberglass, or wood could be substituted for aluminum in applications where these materials have been used previously. Steel, stainless steel, magnesium, and zinc can be substituted for aluminum in the automotive industry. Magnesium could replace aluminum for certain components in commercial aircraft, and stainless steel and titanium may replace aluminum in jet aircraft. Fiberglass, titanium, and wood may be substituted for aluminum in small boats. Copper could replace aluminum in electrical applications and lead foil or plastics could serve as substitutes in packaging.

The increase in aluminum consumption has resulted, in part, from the decrease in the price of aluminum in relation to other metals. Historically a 1 percent decrease in the ratio of the price of aluminum to the composite price of copper, lead, and zinc has increased aluminum consumption by 1.4 percent.

SECONDARY SOURCES AND RECOVERY

The recovery of secondary aluminum, from 1954 through 1958, as reported to the Bureau of Mines, averaged 16 percent of the apparent consumption of primary and secondary aluminum. The scrap from which secondary aluminum is recovered is designated as either "new scrap" or "old scrap." New scrap is generated from (1) fabricating operations such as alloying, stamping, forging, extruding, machining, and casting and (2) rejected semifabricated and manufactured items. Old scrap is aluminum that has been used in end products and is collected for metal recovery after the products are worn out or discarded. New scrap consumption and metal recovery data are based on quantities treated outside of the generating plant and do not include "run-around" scrap consumed in the generating plant.

New scrap is the source of nearly 80 percent of the secondary aluminum recovered. The relatively small recovery from old scrap reflects the fact that the aluminum industry is a new and growing industry. Moreover, the high ratio (4:1) of new to old aluminum scrap shows that old aluminum-containing products are not being replaced as rapidly as new ones are going into use. The tonnage of aluminum in use represents a growing reservoir of old scrap for the future.

Consumers of scrap aluminum are divided into four major categories: (1) Secondary smelters, (2) primary producers and fabricators, (3) foundries and miscellaneous manufacturers, and (4) chemical plants. The secondary smelters accounted for 72 percent of the scrap consumed from 1954 through 1958. During this period smelters produced an average of 270,000 tons of secondary aluminum ingot annually. Much of this was consumed in the production of castings.

As indicated by the data in table 7, small quantities of aluminum are recovered from nonaluminum-base alloy scrap and some of the aluminum recovered is consumed in the production of such alloys and also in aluminous chemicals.

RESERVES

Reserves and resources of bauxite are tabulated in the Alumina and Bauxite Chapter.

TABLE 7.—*Aluminum recovered from scrap processed in the United States, by kind of scrap and form of recovery*

[Short tons]

	1957	1958
KIND OF SCRAP		
New scrap:		
Aluminum-base	288, 682	224, 983
Copper-base	124	64
Zinc-base	326	240
Magnesium-base	228	141
Total	289, 360	225, 428
Old scrap:		
Aluminum-base	71, 655	62, 995
Copper-base	115	105
Zinc-base	275	653
Magnesium-base	414	374
Total	72, 459	64, 127
Grand total	361, 819	289, 555
FORM OF RECOVERY		
As metal	9, 218	7, 924
Aluminum alloys	346, 775	277, 197
In brass and bronze	397	217
In zinc-base alloys	2, 880	2, 001
In magnesium alloys	320	242
In chemical compounds	2, 229	1, 974
Grand total	361, 819	289, 555

SOURCES OF STATISTICAL INFORMATION

Data on production, shipments, stocks, and value of primary aluminum are obtained monthly from all domestic producers by the Bureau of Mines. Alumina consumption is obtained annually. The Bureau also canvasses, on a monthly basis, secondary smelters and other scrap consumers to determine stocks and receipts of scrap from which monthly consumption is calculated. Production of ingot by secondary smelters is calculated from their monthly reports of stocks and shipments. Coverage of the secondary aluminum industry is estimated at more than 80 percent. Data on the operations of the members of the Aluminum Smelters Research Institute are obtained from that association. The data on both primary and secondary aluminum are published monthly and annually; the secondary data include an estimate for full coverage of the industry.

The Bureau of the Census collects and publishes monthly data on net shipments of aluminum wrought and cast products. The Bureau of the Census also obtains monthly information on imports and exports of all forms of aluminum. The 1954 Census of Manufacturers included statistics on employment, materials consumed, electric energy purchased, and expenditures for plant and equipment.

With the exception of 1 year, data on aluminum consumption are incomplete. In 1952, under the Controlled Materials Plan, aluminum suppliers were required to report quantities of metal shipped to different segments of the consuming industries. Since then The Aluminum Association has published, semiannually by percent, shipments of wrought products, sand castings, and permanent mold castings to different major uses, as reported by its members. Although coverage is limited to members of the Association which represent about 80 percent of the wrought products producers and a much smaller part of the casting industry, the breakdown for wrought products and sand castings is believed to be representative of the entire industry. The statistics on permanent mold castings are believed not to be representative of the entire aluminum permanent mold casting industry.

PRODUCTION, CONSUMPTION, AND FOREIGN TRADE

In 1900 aluminum was produced in only four countries, and output totaled 7,500 tons. By 1958 there were 25 producing countries having a total production of 3.9 million tons. The United States with a production of 1,566,000 tons accounted for 40 percent of the 1958 world total. Since 1900 the output of the domestic primary aluminum industry has increased at an average rate of 11 percent per year compared to an increase in the Gross National Product of 3 percent per year. From 1951 to 1956 domestic production doubled, and since 1954 aluminum output has been greater than that of any other nonferrous metal.

Figure 2 illustrates the increase in domestic aluminum production since 1940. Table 8 gives the sources of the U. S. aluminum supply, crude and scrap, during the decade 1949 through 1958.

From 1949 to 1958 imports have accounted for an average of 12 percent of the total supply of crude and scrap aluminum. Canada, which supplies much of the world with aluminum, accounted for more than 85 percent of the U. S. imports during the same decade. Only 1.4 percent of the total U. S. supply has been exported during the 10-year period.

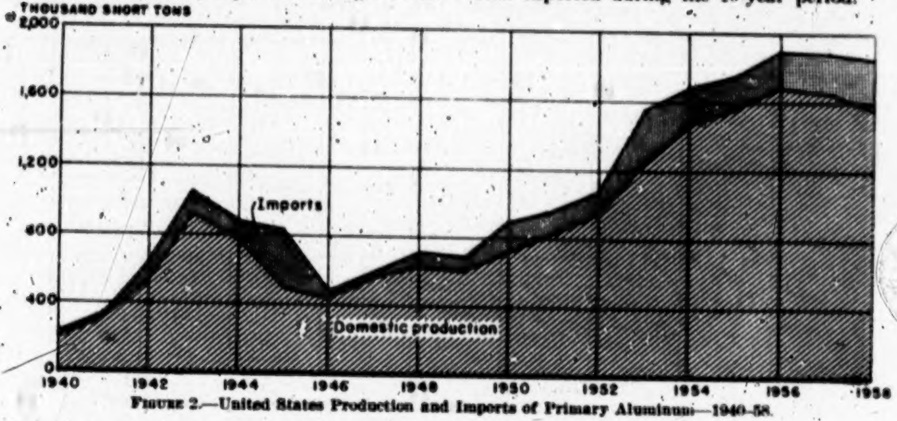

FIGURE 2.—United States Production and Imports of Primary Aluminum—1940–58.

TABLE 8.—*Sources of aluminum supply—crude and scrap*

[Short tons]

Year	Primary production	Recovery from scrap[1]		Imports[2]	Total supply.	Exports[2]
		Old	New			
1949–53 (average)	869, 662	69, 550	208, 475	190, 248	1, 337, 935	4, 168
1954	1, 460, 565	59, 989	232, 052	228, 611	1, 981, 217	39, 448
1955	1, 565, 721	76, 372	259, 622	214, 418	2, 116, 133	22, 430
1956	1, 678, 954	71, 673	268, 095	239, 794	2, 258, 516	52, 014
1957	1, 647, 709	72, 459	289, 360	236, 802	2, 246, 330	45, 454
1958	1, 565, 557	64, 127	225, 428	264, 252	2, 119, 364	69, 726

[1] The 1954–58 data not strictly comparable with previous years, as the figures are recoverable aluminum content whereas previous years were recoverable aluminum-alloy-content.

[2] Crude metal (ingot, pig, slabs, etc.) plus ingot equivalent (wt. × 0.9) of scrap.

TABLE 9.—*World production of aluminum*

[Thousand short tons]

Country	1949–53 (average)	1954	1955	1956	1957	1958
United States	870	1, 461	1, 566	1, 679	1, 648	1, 566
Canada	452	558	612	620	557	646
U.S.S.R.[1]	243	375	475	500	550	605
Iron curtain countries [1]	[2] 33	85	136	143	141	176
France	93	132	142	165	177	186
Germany, West	75	142	151	162	170	151
Norway	52	68	79	101	105	134
Japan	38	59	63	73	75	93
Italy	49	63	68	70	73	71
Austria	31	53	53	65	62	63
Cameroon					8	35
Switzerland	27	29	33	33	34	34
United Kingdom	33	35	27	31	33	30
Other countries	[3] 22	35	45	78	92	100
Total	2, 018	3, 095	3, 460	3, 720	3, 725	3, 890

[1] Estimated.
[2] Average for Czechoslovakia 1953 only; East Germany 1950–53.
[3] Average for Brazil 1951–53.

TABLE 10.—*World production of aluminum by continents*

[Percent]

Continent	1949–53 (average)	1954	1955	1956	1957	1958
North America	65. 5	65. 2	62. 9	61. 8	59. 2	56. 9
Europe	32. 2	32. 3	34. 4	35. 1	36. 9	38. 0
Asia	2. 2	2. 4	2. 6	2. 7	3. 1	3. 6
Africa					. 2	. 9
South America	. 1	. 1	. 1	. 2	. 3	. 3
Oceania-Australia				. 2	. 3	. 3
Total	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

TABLE 11.—*Apparent consumption of aluminum in the United States*

[Short tons]

Year	Primary sold or used by producers	Imports (net) [1]	Recovery from old scrap	Recovery from new scrap	Total apparent consumption
1949–53 (average)	864, 432	186, 869	69, 550	208, 475	1, 329, 326
1954	1, 478, 740	196, 103	[2] 59, 989	[2] 232, 052	1, 966, 884
1955	1, 571, 845	203, 385	[2] 76, 372	[2] 259, 622	2, 111, 224
1956	1, 591, 478	196, 277	[2] 7[illegible], 673	[2] 268, 095	2, 127, 523
1957	[3] 1, 579, 063	195, 644	[2] 72, 459	[2] 289, 360	2, 136, 526
1958	[4] 1, 590, 978	211, 616	[2] 64, 127	[2] 225, 428	2, 092, 149

[1] Crude and semicrude. Includes ingot equivalent of scrap imports and exports (wt. × 0.9).
[2] Not strictly comparable with previous years' data. The 1954–58 data are recoverable aluminum content; previous years' data are recoverable aluminum-alloy content.
[3] Includes 324,311 tons shipped to the Government.
[4] Includes 322,128 tons shipped to the Government.

World production of primary aluminum is given in table 9. In 1958 Canada was the second largest producer, but this position was being challenged by the U.S.S.R. The rapid growth of the U.S.S.R. industry is illustrated by the fact that construction of the first aluminum plant in that country was not started until 1930.

In mid-1958 domestic primary aluminum producers expressed concern over the increased availability of aluminum from the U.S.S.R. on world markets and the undiminished importation of aluminum to the United States when the domestic industry was operating at only 70 percent of capacity. By the year's end exports of aluminum from Iron Curtain countries to the free world had decreased to the normal level.

Statistical information on the consumption of aluminum in the United States by industries

or by end products is incomplete. Total apparent consumption of aluminum, calculated from primary production and primary producers' stock changes, net imports of crude, semicrude and scrap, and recovery from scrap, is shown in table 11. These consumption figures do not allow for stock changes at any consumption level, at secondary smelters, nor for metal going to Government stocks.

SELF-SUFFICIENCY

As indicated in the previous section an average of only 12 percent of the U. S. aluminum supply was imported during 1949 to 1958. The capacity of the domestic industry always has been approximately equal to the demand. Domestic supplies of economically competitive bauxite are limited, and bauxite imports in 1958 accounted for 86 percent of the total ore supply. (For further details see the Alumina and Bauxite Chapter.)

STRATEGIC CONSIDERATIONS

Aluminum is on Group I of the list of strategic and critical materials for stockpiling. Government stocks have been acquired, and at the end of 1958 the inventory approximately equaled or exceeded the basic and maximum objectives.

In view of the stockpile position, the fact that the major import source is Canada, the geographic dispersion of the industry, and a 35 percent increase in domestic production capacity since 1955, the strategic position of primary and secondary aluminum, exclusive of ore supplies, is good.

DEFENSE PROGRAM

Under the impetus of both World War II and the Korean hostilities, domestic primary aluminum capacity expanded sharply. During these periods (1941–45 and 1951–52) aluminum came under the Controlled Materials Plan and the metal was distributed under a system of priorities.

Primary production capacity was 245,000 tons in 1940 and owned by one company, Alcoa. By 1943 capacity was increased to 1,164,000 tons including 668,000 tons belonging to the Government and 80,000 tons owned by Reynolds. Peak wartime production of 920,000 tons was reached in 1943, and then as supplies exceeded demand, production dropped to a postwar low of 410,000 tons in 1946. After the war Government plants, which were not economically competitive, were sold and converted to nonaluminum uses. Those which could be operated competitively were sold to Alcoa, Reynolds, or Kaiser (then Permanente Metals Corp.). After disposal of the Government plants, domestic primary aluminum capacity was 680,000 tons.

The pattern of the industry was unchanged from 1946 until the Korean hostilities. From 1951 through 1954 inclusive, 613,000 tons of Government-aided capacity came into production. Expansion during this period differed from World War II expansion in that none of the facilities were owned by the Government and all were located near electric power sources, which would permit economic operation of the plants in peacetime. The Government issued accelerated tax amortization certificates and entered into market guarantee contracts with the companies. Market guarantee contracts with Aloca and Kaiser expired late in 1958, and the contract with Reynolds was scheduled to expire by mid-1959. The expiration date of the remaining contract with Harvey Aluminum, Inc., was indefinite, but it will probably end in 1963. During 1957 and 1958, under these guarantees, the three largest producers shipped 647,000 tons of aluminum to the Government.

PRICES AND COSTS

The aluminum industry's price policy probably has been an important factor in the rapidly increasing usage of the metal by many consuming industries. While prices of other major nonferrous metals have increased between 100 to 150 percent from 1939 to 1959, the price of aluminum ingot increased only 34 percent during the same period. The average price of aluminum ingot in 1925 was 28.2 cents a pound and gradually decreased to the World War II price of 15.0 cents a pound. The first increase was in 1948, but the 1925 price was not approached until August 1957 when the postwar high of 28.1 cents a pound was reached. At the end of 1958 the price of ingot was 26.8 cents a pound.

Primary aluminum prices are relatively stable. Sharp fluctuations in the supply-demand balance are reflected in changes in scrap and secondary ingot prices. When aluminum was in short supply in 1955, the average price of two widely used alloys produced from scrap was 5 cents a pound more than the price of primary ingot.

One company reported the following mill costs (in cents a pound of pig) for 1953 (*18*):

Raw materials (includes alumina at cost including transportation and alloying materials)	4.71
Energy (for reduction only)	2.93
Manufacturing costs	6.43
Total	14.07

Transportation costs on shipments of pig, general administrative expense, and selling expense brought the total cost to 16.20 cents a

pound of pig. The average price of pig in the United States in 1953 was 19.7 cents a pound.

TARIFF

The Tariff Act of 1930 established an import duty of 4 cents a pound on crude aluminum. This was reduced to 3 cents in 1939. Pursuant to the General Agreement on Tariffs and Trade the duty was reduced to 2 cents a pound in 1948 and to 1½ cents in June 1951. Further negotiations under the agreement in 1956 resulted in three periodic reductions to the 1.25 cents a pound tariff that became effective July 1958. At that time the duty on typical aluminum manufactures was 3.5 cents a pound plus 17 percent ad valorem.

TRANSPORTATION

Much of the aluminum produced in the Pacific Northwest has been shipped to consuming areas east of the Mississippi River. The proximity of the new plants in the Ohio River Valley to the consuming areas results in lower transportation costs. Movement of alumina, by rail, from the alumina plants in the South Central United States to the consuming plants in the Northwest and Northeast represents a considerable item of cost.

GOVERNMENT POLICIES

As described in the section, Defense Program, the Government, through direct financing or incentives, has encouraged expansion of the aluminum industry from the mine through semifabricating facilities. Government programs have focused on promotion of a competitive industry and have resulted in the entry of new producers and assured that part of the production from new facilities will be made available to nonintegrated consumers of crude aluminum. Government policies relating to the development of power in agricultural areas have also had a profound effect on the formation and location of the industry.

RESEARCH

To hold markets won by displacing traditionally used materials and to continue to expand into new fields and applications, the aluminum industry, in 1958, spent more than $25 million on research and product development. This expenditure included research on bauxite and alumina production and utilization.

Industrial research covers the entire field of metal production, from the reduction cell, through the development of alloys and casting techniques, the study of protective and decorative finishes, and detailed investigations of end use applications of the metal. The producers develop technical data for their own use, as well as for the use of their customers.

Over the years, intensive efforts to improve the efficiency of the reduction step have resulted in significant decreases in power and manpower requirements. In 1938 power requirements were 10 to 11.5 kw.-hr. per pound of metal produced. Plants built since 1950 require only 7.5 to 8.5 kw.-hr. per pound. Manpower requirements have decreased from nearly 100 manhours per ton in 1939 to 24 manhours in 1954.

The industry's continuing alloy research program has resulted in the development of alloys with increased strength at elevated temperatures, increased electrical conductivity and improved corrosion resistance. Anodizing processes have been developed to protect and color aluminum surfaces. Methods of surface treatment and new basic materials have been developed in recent years to increase the commercial application of aluminum products protected by vitreous enamels.

From 1955 to 1959 the aluminum industry directed a major part of its end product development effort toward the automotive industry. The success of the effort was shown by the increased use of aluminum in automobiles and recent adoption of an air-cooled aluminum engine by one manufacturer. Applications in architecture and home building and packaging and containers also have been the subject of intensive investigation.

The Bureau of Mines at the Northwest Electrodevelopment Experiment Station, Albany, Oreg., began research late in 1951, under a cooperative agreement with Apex Smelting Co. of Chicago, to develop a smelting technique for producing aluminum-silicon alloy in a 3-phase ferroalloy-type arc furnace. A mixture of hogged fuel and coke proved to be promising as a reducing agent. Based on the work at Albany, the National Metallurgical Corp., a subsidiary of Apex Smelting Co., installed a commercial-size furnace for the production of silicon at Springfield, Oreg.

Subsequently, the Bureau conducted independent smelting research on the use of wood chips and coke in an arc furnace to smelt aluminum silicates containing 20 to 55 percent alumina, as a means of recovering aluminum from nonbauxitic sources. The early phases of this research have been described (*3*).

The Bureau of Mines was also investigating methods for producing commercial-grade aluminum from the crude aluminum-silicon alloys made by carbothermic reduction of domestic clays. One method involved leaching the crude alloy with molten zinc to selectively dissolve the aluminum, which was then recovered by distillation of the zinc.

The Bureau has also initiated research on the

fundamental physical chemistry of fused salt electrolysis in the aluminum reduction cell. The cathode and anode processes in the electrolysis of the fused cryolite bath were being studied and pertinent physical, chemical, and thermodynamic data obtained.

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PLAINTIFF'S EXHIBIT 421c

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
preprinted from BULLETIN 585

COPPER

BY A. D. McMAHON

a chapter from

MINERAL FACTS AND PROBLEMS, 1960 EDITION

1910

THE BUREAU OF MINES 50TH ANNIVERSARY

1960

UNITED STATES DEPARTMENT OF THE INTERIOR • Fred A. Seaton, Secretary

BUREAU OF MINES • Marling J. Ankeny, Director

This publication is a chapter from Bulletin 585, MINERAL FACTS AND PROBLEMS, 1960 edition. The complete volume, covering all mineral commodities, may be purchased from the Superintendent of Documents, Washington 25, D.C., at a date to be announced later.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. - Price 20 cents

[fol. 5861]
2676

COPPER

By A. D. McMahon[1]

COPPER has been associated with the progress of civilization since prehistoric times, possibly as long ago as 6000 B.C. However, the acceleration in growth of world demand from 10,000 to 4 million tons annually has occurred in the past 150 years as a result of the development of electrical power and expansion of the brass and bronze industry.

SUMMARY

The progressive expansion of copper production in the United States began with the discovery of large deposits of native copper near Lake Superior in Michigan about 1845. Extensive ore bodies were found in Arizona, Montana, New Mexico, and Utah in the last half of the 19th century, and today the mining districts in these States account for approximately 85 percent of the Nation's mine production, which grew from 730 tons of recoverable copper in 1850 to about 1 million tons annually since 1955.

Copper mining, smelting, and refining in the United States are largely controlled by 4 companies; and, of the 30 large fabricators of raw copper, the plants handling over 50 percent of the total volume of business are owned or controlled by the large copper producers. They have completely integrated operations from the mines to the finished copper and copper-alloy products. The large copper deposits outside the United States are similarly controlled; Chile's production is derived mostly from three mines owned by two American companies; Northern Rhodesia's output comes from four large mines; one company controls Belgian Congo's several mines which are worked as a unit; and three mines account for nearly three-quarters of Canada's output.

Copper ores occur in many types of deposits associated with igneous, sedimentary and metamorphic rocks. Porphyry copper deposits make up most of the world's reserve and are mined principally by open-pit or block-caving methods. In 1958 open-pit mining accounted for 76 percent of the ore mined and 71 percent of the copper produced in the United States.

Most of the present copper production is derived from sulfide ores beneficiated by flotation. This process has been highly perfected for the sulfide minerals, but only a measure of success has been attained on copper carbonates, and flotation of the copper silicates remains to be solved.

Smelting sulfide concentrate involves producing a matte and slag in a reverberatory furnace and then oxidizing the sulfur and iron in the matte in a converter to release copper metal. Impurities in the copper are removed by electrolytic or fire refining.

Leaching followed by cementation or electrolysis is the process used to recover copper from oxide ores—carbonates and silicates. Recovery of copper from mixed oxide-sulfide ores is more difficult but is accomplished by ferric sulfide leaching or leach-precipitation-flotation. About 9 percent of the U.S. production of copper comes from ores treated by hydrometallurgical methods.

Copper is widely used because it has high electrical conductivity, high heat conductivity, good corrosion resistance, and because it is strong, yet malleable and ductile and can be alloyed readily with many other metals to acquire or impart desirable characteristics. Nearly half of the copper consumed is used in virtually pure metallic form, primarily by the electrical industry in manufacturing generators, motors, electric locomotives, switchboards, telephone and telegraph equipment, light and power lines, and other items. Most of the remainder is used in manufacturing brass, bronze, and other copper alloys. During war, copper's chief uses are for military materiel requirements and for essential industrial production. Aluminum serves as a substitute for copper and its alloys in a number of electrical, mechanical, and decorative applications; stainless steels, copper clad metals, and plastics have also replaced copper for some uses.

Progress in conservational practices have been made possible by technological advances in mining, metallurgy, and equipment design. One of the most important measures is the reclamation of copper from scrap that provides nearly one-fourth of the U.S. supply.

[1] Commodity specialist.

In the United States the price of copper quoted by the principal producers fell from an alltime high of 46 cents a pound in July 1956 to 25 cents in January 1958. The quotation moved up 1½ cents in July 1958, indicating some market strength. Reestablishment of the copper excise tax July 1, 1958 and effective cuts in mine production halted the decline in price. By October 24, copper was quoted at 29 cents.

Mine production in 1958 was at the annual rate of 979,000 tons. Production and consumption of copper usually follow the general trend of the economy. Planned expansion at established mines and development of new properties continued, indicating that producers are confident in the long-term outlook for an increased demand. Consumption of new copper in the United States is expected to parallel population increase. Copper consumption for new uses will be offset by further encroachment of aluminum and other substitutes. Reports of planned foreign power projects, industrial expansions, and development of backward areas indicate substantial future increases in foreign requirements for copper.

The major problems facing the copper industry today are in the marketing and utilization fields, which involve development of new uses, price, competitive metals, competitive foreign production, and conservation in mining and processing.

The United States has been the largest copper producing and consuming country in the world for many years. Before World War II, production exceeded domestic consumption, but the large war and postwar requirements resulted in a prolonged shortage even though about one-fourth of the total supply was provided by imports. Spurred by Defense legislation, the principal producers increased capacity to reach a supply-demand balance in early 1956. A downturn in U.S. demand beginning about the middle of 1956 led to cutbacks in mine production in 1957 and 1958 to equalize output with consumption. There was no slackening in foreign demand however, and world production reached an alltime high in 1957.

Chile, Canada, Mexico, Peru, Northern Rhodesia, and the Belgian Congo provide approximately 85 percent of the U.S. receipts of foreign copper. The copper excise tax which had been suspended by Acts of Congress since April 30, 1947, except for a short period (July 1, 1950–April 1, 1951), became effective July 1, 1958 at 1.7 cents per pound. Because of the easier supply situation, export controls on refined copper were removed in September 1956, and 1958 exports rose to the highest level since 1929.

The world reserve of copper, in terms of metal content, is estimated at 170 million tons of copper. The principal resources accounting for 93 percent of this total are in 7 countries: Chile, Peru, United States, Northern Rhodesia, Belgian Congo, U.S.S.R., and Canada. The large quantity of copper in use and recoverable in the form of scrap provides an additional dependable reserve of available copper; in the United States this source is estimated to be about 30 million tons.

BACKGROUND

Copper was probably the second metal used by man, gold was the first. The very early history of copper is obscure, but according to the theories of some archaeologists and anthropologists, its first appearance was associated with the Neolithic civilization during the late Stone Age. Discovery is believed to have been about 6000 B.C. The early age of copper probably had its greatest development in Egypt. Definite records have been found of the working of the copper mines on the Sinai Peninsula by King Seneferu about 3800 B.C., and the discovery of crucibles at these mines indicates that the early art of extracting the metal included some refining.

Little is known about ancient copper mining, although it is certain that both open-cut and underground mining was practiced. The most important copper-ore deposits were in Sinai, Syria, Baluchistan and Afghanistan, Caucasia and Transcaucasia, the Taurus region, Cyprus, Macedonia, Iberia, and Central Europe. The copper in use among the Sumerians of southern Mesopotamia (3500–3000 B.C.) was obtained from Asia Minor (where certain ores contain the same impurities as are found in metal relics) which also supplied the Assyrians much later. The production peaks in this region fall between 2400–2000 B.C. and 1500–1200 B.C.

Copper was worked in many parts of Egypt from Dynasty III (2600 B.C.) onward. About 10,000 tons was produced over 1,500 years; thereafter Egypt became dependent upon imports from Cyprus and Armenia. In Cyprus, copper mining began about 2500 B.C. The mines were operated successively under the dominion of the Egyptians, Assyrians, Phoenicians, Greeks, Persians, and the Romans. The same deposit produced 37,000 tons of copper in 1958.

European copper mines belonging to the Bronze Age are known in Austria, Germany, France, Spain, Portugal, Greece, and Tirol (Tyrol). In Tirol, the mines of Mitterberg

seem to have been worked from about 1600 B.C. in the Bronze Age to the Hallstatt period of the Iron Age, about 800 B.C. Probably the most important copper deposits in Europe were those of Spain and Portugal including the outstanding Rio Tinto ore body which is still being mined. In Britain copper deposits found in Anglesey, Cornwall, Devon, and Shropshire are of historical interest, having been developed by the Romans after the great invasion of 43 A.D.

The Copper Age in the Americas probably dawned between 100 and 200 A.D. Although some bronze appeared about this time in South America, a so-called Bronze Age was not evident, and both North and South America passed more or less directly from Copper into the Iron Age. Copper was first produced in the American Colonies in 1709 at Simsbury, Conn.; the Spaniards are credited with finding the copper-producing area of southwestern New Mexico about 1800; and a significant ore body (Ely mine) was discovered in Orange County, Vt., in 1820. However, it was not until after the discovery of the Northern Michigan ore deposits in the early 1840's that production in the United States exceeded a few hundred tons a year. Extensive ore bodies were found in Montana and Arizona during 1860–80. Smelter output from domestic ores increased from 728 tons in 1850 to 30,240 in 1880. The first of the large low-grade porphyry ore bodies, at Bingham, Utah, was brought into production by the Utah Copper Co. (later absorbed by the Kennecott Copper Corp.) in 1906. The ore dressing methods and procedures of flotation that were developed to process successfully tremendous quantities of low-grade copper ores encouraged search for and development of other porphyry deposits that account for most of the domestic copper reserve.

SIZE AND ORGANIZATION OF THE INDUSTRY

The value of copper output in the United States is second only to iron among metals. The United States has been the largest copper-producing country in the world since 1883, except for 1934 when Chile ranked first. In 1958, the United States produced 26 and 25 percent, respectively, of world mine and smelter production. Other principal copper-producing countries were Chile, U.S.S.R., Northern Rhodesia, Canada, and Belgian Congo in that order. Countries of the western hemisphere produced 53 percent of the world's total mine output.

The primary copper industry of the United States is composed of approximately 200 companies engaged in the production and sale of copper. The principal segments of the industry—mining, smelting, refining, fabricating, and marketing—are dominated in varying degrees by a few large vertically integrated companies.

Twenty-five mines produced 97 percent of the domestic copper output in 1958; the 5 largest produced 52 percent, and the 10 leading mines furnished 76 percent. The balance was supplied by small copper mines and producers of other ores, which contained recoverable byproduct copper. Three companies, Kennecott Copper Corp., Phelps Dodge Corp., and The Anaconda Co., usually account for about three-fourths of the annual domestic mine production. Kennecott and Phelps Dodge are by far the largest producers and supply about 35 percent and 25 percent, respectively, of the total each year. The principal copper-mining companies in the United States in 1958 were:

Company	Recoverable copper content of ore mined (short tons)	Percent of U.S. total
Kennecott Copper Corp.	319,000	33
Phelps Dodge Corp.	218,000	22
The Anaconda Co.	112,000	12
San Manuel Copper Corp.	75,000	8
Inspiration Consolidated Copper Co.	42,000	4
White Pine Copper Co.	41,000	4
Miami Copper Co. (including Copper Cities)	33,000	3
Magma Copper Co.	21,000	2
Total, above companies	862,000	88
Total, United States	979,000	

Copper-smelting capacity (exclusive of the Lake smelters in Michigan) in the United States in 1958 totaled approximately 3.6 million tons of charge. Four companies control about 90 percent of this capacity. Copper-smelting companies and their approximate percentage of the total U.S. smelting capacity are:

Company	Percent of total capacity (charge)
Phelps Dodge Corp. and Phelps Dodge Refining Corp.	31
Kennecott Copper Corp.	23
American Smelting & Refining Co.	15
The Anaconda Co.	12
International Smelting & Refining Co.[1]	6
San Manuel Copper Corp.	4
American Metal Climax, Inc.	3
Magma Copper Co.	2
Tennessee Copper Co.	1
Total	100

[1] A subsidiary of The Anaconda Co.

Lake-smelter capacity in 1958 totaled 157,000 tons, as follows:

	Short tons
Calumet & Hecla, Inc.	100,000
White Pine Copper Co.	45,000
Quincy Mining Co.	12,000

Electrolytic copper refining capacity in the United States in 1958 was about 1,762,000 tons. Three companies dominate this section of the copper industry and control almost 80 percent of the annual capacity.

Refining companies and their approximate percentages of the U.S. electrolytic refinery capacity in 1958 are:

Company	Percent of total U.S. capacity
American Smelting & Refining Co.	27
Phelps Dodge Corp.	27
International Smelting & Refining Co.[1]	14
Kennecott Copper Corp.	12
American Metal Climax, Inc.	8
The Anaconda Co.	8
Inspiration Consolidated Copper Co.[2]	3
Cerro de Pasco Corp.	1
Total	100

[1] A subsidiary of The Anaconda Co.
[2] 28 percent controlled by The Anaconda Co.

Kennecott Refining Corporation was constructing an electrolytic refinery near Baltimore, Md., in 1959, it will have an annual capacity of 200,000 tons.

About 10 percent of the primary refined copper produced in the United States is fire refined in Michigan, New Mexico, Texas, and New Jersey from crude materials produced in Michigan, New Mexico, and Arizona, and from foreign crude materials.

There are about 30 large copper fabricating companies in the United States making sheet, strip, wire, rods, pipe and other extruded and rolled shapes. Twelve of these companies handle over 50 percent of the total volume of business and are owned or controlled by the large copper producers, giving them completely integrated operations from the mines to finished copper and brass products. The following fabricating companies are controlled by these companies.

Fabricating company	*Controlled by*
Chase Brass & Copper Co.	Kennecott Copper Corp.
Kennecott Wire & Cable Division, The Okonite Co.	Kennecott Copper Corp.
American Brass Co.	The Anaconda Co.
Anaconda Wire & Cable Co.	The Anaconda Co.
Phelps Dodge Copper Products Corp.	Phelps Dodge Corp.
Revere Copper & Brass Co., Inc.	American Smelting & Refining Co.
General Cable Corp.	American Smelting & Refining Co.
Wolverine Tube Corp.	Calumet & Hecla, Inc.
C. G. Hussey & Co.	Copper Range Co.
New Haven Copper Co.	Tennessee Corp.
Titan Metal Manufacturing Co.	Cerro de Pasco Corp.
Lewin Mathes Co.	Cerro de Pasco Corp.

The larger independent fabricators not now controlled by the major producers include:

Bridgeport Brass Co.
Bristol Brass Corp.
Chicago Extruded Metals
Olin Mathieson Chemical Corp.
Mueller Brass Co.
Reading Tube Co.
J. A. Roebling's Sons Div., the Colorado Fuel & Iron Corp.
Rome Cable Corp.
Scovill Manufacturing Co.
Triangle Wire & Cable Co., Inc.
Volco Brass & Copper Co.

GEOGRAPHIC DISTRIBUTION OF THE INDUSTRY

Copper is widely distributed in nature, and almost every country has some copper-ore deposits; 22 countries each mined over 10,000 tons of recoverable copper in 1958, and about 20 other countries recorded some output. In spite of the wide distribution, there are relatively few large copper mining areas in the world.

Most of the copper produced in the United States comes from five Western States. Chile's production comes principally from three mines; Northern Rhodesia's output from four large mines; Belgian Congo's production from properties of one company, and three mines supply about 75 percent of Canada's output.

Concentration mills and smelters are usually near the principal mines and some process custom ores from smaller producers. There are eight smelters in Arizona; one each in Utah, Montana, Nevada, New Mexico, and Tennessee, one in Texas, and one each at seaports in Washington, New York, and New Jersey.

About 55 percent of the electrolytic refining capacity is accounted for by five refineries on the Atlantic Coast in New York City, Carteret and Perth Amboy, N.J., and Baltimore, Md.; five electrolytic refineries in Arizona, Washington, Montana, Utah, and Texas provide the remainder. Three Michigan plants fire-refine Lake copper, and fire-refined copper is also produced in New Mexico, Texas, and New Jersey.

Most of the major copper-fabricating plants (brass and wire mills) are in the Connecticut Valley area. Two California plants were

placed in operation in 1957. Secondary smelters are far less concentrated, and about 3,000 foundries and miscellaneous users of copper materials are scattered throughout the United States.

For many years before World War II, U.S. smelting and refining capacity was excessive for treating domestic materials, and the excess capacity was used to treat substantial quantities of foreign crude materials. Since the war, foreign producers have made great progress in building their own reduction plants. In 1958 there were approximately 95 primary smelters and refineries in 25 foreign countries.

DEFINITION OF TERMS, GRADES, AND SPECIFICATIONS

There are three basic classes of commercial copper that arise from the high affinity of molten copper for oxygen, and the methods employed for its control. They are designated as Tough Pitch Copper, Oxygen-Free Copper, and Deoxidized Copper. Several types of each class of commercial copper are available in refinery shapes, and wrought and cast products. Eighteen such types are recognized by the American Society for Testing Materials in its Classification of Coppers. This classification is shown in table 1 and the terms used are defined as follows:

TABLE 1.—*Classification of coppers*

Designation	Type of copper	Forms in which available							
		From refiners				From fabricators			
		Wire bars	Billets	Cakes	Ingots and ingot bars	Flat products	Pipe and tube	Rod and wire	Shapes
Cath.	Electrolytic cathode	Available in cathodes only.							
		Tough pitch coppers							
ETP	Electrolytic tough pitch	X	X	X	X	X	X	X	X
FRHC	Fire-refined high conductivity tough pitch	X	X	X	X	X	X	X	X
FRTP	Fire-refined tough pitch		X	X	X	X	X		X
ATP	Arsenical tough pitch		X	X		X	X	X	
STP	Silver bearing tough pitch	X	X	X	X	X	X	X	X
SATP	Silver bearing arsenical tough pitch		X	X		X	X		
CAST	Casting				X				
		Oxygen-free coppers							
OF	Oxygen-free without residual deoxidants	X	X	X		X	X	X	X
OFP	Oxygen-free, phosphorus bearing	X	X	X		X	X	X	
OFPTE	Oxygen-free, phosphorus and tellurium bearing		X					X	X
OFS	Oxygen-free, silver bearing	X	X	X		X		X	X
OFTE	Oxygen-free, tellurium bearing		X					X	X
		Deoxidized coppers							
DHP	Phosphorized, high residual phosphorus	X	X	X		X	X	X	X
DLP	Phosphorized, low residual phosphorus		X	X		X	X	X	X
DPS	Phosphorized, silver bearing		X	X		X	X		X
DPA	Phosphorized, arsenical		X			X	X		
DPTE	Phosphorized, tellurium bearing		X					X	X

Electrolytic copper is that refined by electrolytic deposition. *Fire-refined copper* is refined by using a furnace process only. *Tough-pitch copper* is electrolytic or fire-refined copper cast in refinery shapes and containing a controlled quantity of oxygen in cuprous oxide. *Oxygen-free copper* is refined copper cast under a deoxidizing atmosphere that eliminates all cuprous oxide without using metallic or metalloidal deoxidizers. *Deoxidized copper* is refined copper freed from cuprous oxide through use of metallic or metalloidal deoxidizers.

High conductivity copper has a minimum conductivity of 100 percent I.A.C.S. in the annealed condition. *Casting copper* is fire-refined tough-pitch copper, usually derived from secondary metal and cast into ingot and ingot bars only for use in making foundry castings, but no wrought products. *Phosphorized copper* is a general term applied to copper deoxidized with phosphorus. It is the most commonly used deoxidized copper. *Arsenical copper*, *phosphorus bearing copper*, *silver bearing copper*, *tellurium bearing copper*.—Copper containing the designated element in

amounts as agreed upon between the supplier and the consumer. Any of these alloyed coppers can be produced as tough-pitch, oxygen-free, or deoxidized varieties. Table 1 shows the ones commonly supplied.

Several refinery shapes are made depending partly on the end use of the copper.

Wire bar is a refinery shape for rolling into rod (and subsequent drawing into wire), strip or shape. Wire bars are approximately 3½ to 5 inches square in cross-section, usually from 38 to 54 inches in length, and weighing from 135 to 420 pounds. They are tapered at both ends when used for rolling into rod for subsequent wire drawing and may be unpointed when used for rolling into strip. *Cake* is used for rolling into plate, sheet, strip, or shape. It is rectangular in cross-section of various sizes and ranges from 140 to 4,000 pounds or more in weight. The refinery shape used primarily for tube manufacture is termed billet. It is circular in cross-section, usually 3 to 10 inches in diameter and in lengths up to 52 inches; weight from 100 to 1,500 pounds. *Ingot and ingot bars* are employed for alloy production (not fabrication). Ingots usually weigh from 20 to 35 pounds and ingot bars from 50 to 70 pounds. Both usually are notched to facilitate breaking into smaller pieces and are used for remelting. Unmelted flat plate produced by electrolytic refining is called *cathode*. The customary size is about 3 feet square and about ½ to ⅞ inches thick, weighing up to 280 pounds.

Copper is graded principally according to its chemical composition and electrical resistivity. Specifications adopted for selected American Society of Testing Materials (ASTM) designations are as follows:

B4—42 Lake copper wire bars, cakes, slabs, billets, ingots and ingot bars (must originate on the northern peninsula of Michigan).

(*a*) Low resistance lake copper—minimum purity of 99.900 percent, silver being counted as copper.

	Resistivity, maximum International ohm (meter, gram)
Wire bars	0.15328
Cakes, slabs, and billets:	
When specified for electrical use at time of purchase	.15328
Other uses	.15694
Ingots and ingot bars	.15694

(*b*) High resistance Lake copper—minimum purity of 99.900 percent, silver and arsenic being counted as copper. Lake copper, having a resistivity at a temperature of 20° C. (68° F.) greater than 0.15694 ohm (meter, gram), shall be known as "high resistance lake."

B5—43 Electrolytic copper wire bars, cakes, slabs, billets, ingots and ingot bars—minimum purity of 99.900 percent, silver being counted as copper.

	Resistivity, maximum International ohm (meter, gram)
Wire bars	0.15328
Cakes, slabs, and billets:	
When specified for electrical use at time of purchase	.15328
Other uses	.15694
Ingots and ingot bars	.15694

B115—43 Electrolytic cathode copper—minimum purity of 99.90 percent, silver being counted as copper. The copper shall have a resistivity not to exceed 0.15328 international ohms per metergram at 20° C. (annealed).

B170—47 Electrolytic copper, oxygen-free, wire bars, billets, and cakes—minimum purity of 99.92 percent, silver being counted as copper. The copper in all shapes shall have a resistivity not to exceed 0.15328 ohms (meter, gram) at 20° C. (annealed).

B72—55T Fire-refined casting copper—must conform to the following requirements as to chemical composition:

	Grade A percent	*Grade B percent*
Copper plus silver, minimum	99.75	99.50
Arsenic, maximum	.0075	.10
Antimony, maximum	.012	.012
Bismuth, maximum	.003	.003
Iron, maximum	.010	.010
Lead, maximum	.100	.30
Nickel, maximum	.10	.10
Oxygen, maximum	.10	.10
Selenium, maximum	.040	.040
Sulfur, maximum	.01	.01
Tellurium, maximum	.014	.014
Tin, maximum	.025	.05

B216—49 Fire-refined copper for wrought products and alloys—must conform to the following requirements as to chemical composition. (No resistivity specifications.)

	Percent
Copper plus silver, minimum	99.88
Arsenic, maximum	.012
Antimony, maximum	.003
Selenium plus tellurium, maximum	.025
Nickel, maximum	.05
Bismuth, maximum	.003
Lead, maximum	.004

COPPER-BASE ALLOY TERMS

Copper and copper-base alloys comprise a series of metals that include all the alloys which are at least 40 percent copper and where the amount of copper is not less than the amount of any other constituent. There are essentially four well-known kinds of copper-base alloys, e.g. brass, bronze, nickel-silver, and cupro-nickel. Modern nomenclature for certain compositions departs from the original concept that brasses are copper-zinc alloys and bronzes principally copper and tin. Metallurgical research has developed important new alloys and necessitated revision of many original, simple definitions.

Brass may be defined as any copper-base alloy containing zinc as the principal alloying constituent, with or without smaller quantities of other elements. Some of the alloys known as nickel-silver could be termed "brasses," but

these alloys also possess enough distinctive qualities to warrant separate classification. There are alloys that are definitely brasses by definition, yet have names that include the word "bronze;" for example, *commercial bronze* containing 90 percent copper and 10 percent zinc.

The term *bronze* is seldom used alone and the copper-tin alloys have come to be known as *phosphor bronze* because of the small residual phosphorus content. With a suitable modifier the term *bronze* also extends to various copper-base alloy systems where the principal alloying element is other than tin or zinc. These systems include *aluminum bronzes*, *beryllium bronzes*, and *silicon bronzes*.

Nickel-silver, formerly known as German silver, is a copper-alloy containing both nickel and zinc. Its name derives from its predominantly silvery color. *Cupro-nickels* are essentially copper and nickel, the nickel content usually 10, 20, or 30 percent. In addition to these, there are many special and proprietary alloys that include *aluminum-tin bronze*, *aluminum-silicon bronze*, *cadmium bronze*, *chromium copper*, *beryllium copper*, *leaded copper*, and *selenium copper*.

Copper-base alloys are also grouped in two classes according to specifications required in the processes of fabrication. These two classes are wrought alloys and casting or foundry alloys. The *wrought alloys* of copper are regarded as only those made by alloying the various components and casting into slabs, cakes, or billets for hot or cold rolling, drawing, extrusion, or forging. *Casting alloys* are made from a complex assortment of industrial nonferrous scrap by scientific selection, smelting, and refining processes. Many compositions suitable for casting in sand or permanent molds are entirely unfit for working operations.

TECHNOLOGY

GEOLOGY

Deposits of copper are found in a variety of host rocks under greatly varied structural conditions. The periods of their formation range from Precambian to Tertiary, embracing most of known geologic time.

Copper deposits are characteristically associated, both in time and place of formation, with igneous activity. With the Tertiary deposits, and less notable with earlier deposits, both extrusive and intrusive rocks are present. In most copper districts the igneous rocks are of intermediate composition (diorites and monzonites), with the quartzose and porphyritic phases in the intrusive bodies and corresponding compositions in the extrusive rocks.

Most copper deposits are associated in origin with intrusive bodies, and the deposits tend to group around relatively small stocks or cupolas that are upward projections of batholiths. There is, however, a notable difference in the relation of different types of deposits to the stocks. In the United States the Tertiary copper deposits of the eastern Cordilleran region are in and grouped around the tops of stocks. Much of the copper occurs in the stocks, and most of it is within a few thousand feet of the stocks. The deposits of pre-Cambrian, Paleozoic, and part of those of Mesozoic Age are not so closely associated with exposed stocks. In fact, many of them are several miles from known intrusive bodies, and relatively little copper occurs in stocks. The difference seems to be due to the distance below the surface at which the igneous bodies are intruded and the copper deposits are formed.

Many of the Tertiary stocks were intruded near the surface, as they cut lavas of the same general age which were at most a few thousand feet thick. Solutions moving to the top of and outward from such bodies could not travel far before the change in heat and pressure would cause precipitation of copper minerals in or only a few thousand feet from the stock. Solutions from bodies that were far below the surface could travel farther from the source before loss of heat and decrease of pressure would cause precipitation of copper minerals; therefore, the deposits may be thousands of feet from their igneous source.

Copper occurs in many mineral combinations both in hypogene and supergene deposits. For hypogene deposits associated with igneous rocks, in which copper is the chief metal of economic value, there is not a very wide range in the temperature of deposition, but variations in physical and chemical conditions give corresponding variations in types of deposits. This does not imply that copper does not deposit over a considerable range of temperatures, because copper combined with iron as chalcopyrite or cubanite apparently deposits at a higher temperature than that combined with antimony as tetrahedrite or with sulfur as simple copper sulfide, chalcocite.

Copper deposits are commonly classified as porphyry, cupriferous pyrite, sedimentary, and vein deposits.

Porphyry copper deposits contain most of the world's estimated commercial reserve of copper. Porphyry is an igneous rock in which larger crystals are set in a finer groundmass. In the commercial sense the term *porphyry copper deposits* is not restricted to ore in porphyry but is applied to deposits characterized by huge size, uniform mineral dissemi-

nation, and low average copper content. Many porphyry copper deposits were formed by the secondary enrichment of lean primary sulfides brought about by weathering or other surficial processes and subsequent leaching and deposition of the copper at lower levels from descending surface waters. This action usually develops an upper leached zone containing oxide minerals underlain by an enriched section of higher grade sulfide ores. In most porphyry deposits the primary mineralization is of sufficient grade to constitute an ore of copper. The major porphyry copper deposits of the world are in Southwestern and Western United States, Chile, Peru, and U.S.S.R.; there are smaller deposits in Mexico and Canada.

In the Central African copper belt, the copper ores of Northern Rhodesia occur in *sedimentary deposits* underlain by metamorphic and igneous rocks and overlain by a thick series of younger sediments. The sedimentary beds have been strongly folded into a series of complex anticlines and synclines. The anticlines have been eroded and leave down folded basins of the synclines in the older underlying rocks where concentrations of copper minerals are found. Most of the orebodies consist of sulfide ore, but considerable oxidized ore occurs in certain sections. Belgian Congo deposits are similar to those of Northern Rhodesia except for tighter folding and more abundant faulting. The better known occurrences consist of oxidized ore near the surface but large sulfide deposits exist at depth.

Cupriferous pyrite deposits are usually lenticular or podshaped, contain pyrite and/or pyrrhotite, with chalcopyrite, and are found in crystalline schists or slates lying parallel with the foliation. Pyritic lenses were at one time the world's main source of copper; noted deposits are in Spain, Cyprus, Turkey, Sweden, and in the United States.

Vein deposits are the result of filling open fissures or of replacing wall rock along narrow cracks, thus forming workable ore bodies. The vein system at Butte, Mont., is characteristic of this type of deposit.

MINERALOGY

Copper is found in nature in numerous minerals and in various combinations with other elements. Some 165 copper minerals are known; however, only about 12 are commercially important and about 6 minerals are the source of over 95 percent of the copper mined. Occasionally enough of the minor minerals are found in some ores to be considered a source of copper, but usually they are associated with the major copper minerals.

The principal copper minerals are as follows:

Mineral	Composition	Specific gravity	Copper percent
Native: Native copper	Cu	[illegible]	100
Oxides:			
Cuprite	Cu_2O	6.0	[illegible]
Tenorite	CuO	[illegible]	[illegible]
Malachite	$CuCO_3 \cdot Cu(OH)_2$	[illegible]	[illegible]
Azurite	$2CuCO_3 \cdot Cu(OH)_2$	3.77	[illegible]
Chrysocolla	[illegible]	[illegible]	[illegible]
Antlerite	[illegible]	[illegible]	[illegible]
Brochantite	[illegible]	[illegible]	[illegible]
Atacamite	[illegible]	[illegible]	[illegible]
Chalcanthite	[illegible]	[illegible]	[illegible]
Sulfides:			
Chalcopyrite	$CuFeS_2$	[illegible]	[illegible]
Bornite	[illegible]	[illegible]	[illegible]
Chalcocite	Cu_2S	[illegible]	[illegible]
Covellite	CuS	[illegible]	[illegible]
Enargite	[illegible]	[illegible]	[illegible]
Tetrahedrite	[illegible]	[illegible]	[illegible]
Tennantite	[illegible]	[illegible]	[illegible]

There are three important groups of copper-bearing minerals. Primary or hypogene minerals, or those deposited at considerable depth in the earth by processes related to igneous activity. Examples of these are bornite, chalcopyrite, enargite, etc. Oxidized copper minerals are formed by weathering of copper sulfides exposed by erosion. Cuprite, malachite, azurite, and chrysocolla are the chief minerals of the oxidized zones of copper deposits. Brochantite and atacamite are found in the upper portions of orebodies in arid regions. The third group is of secondary or supergene sulfides. These minerals are formed when copper is leached from sulfides exposed near the earth's surface, carried downward in solution, and precipitated near water level. The simple sulfides, chalcocite and covellite, are members of this group, although not exclusively so, and other copper-bearing sulfides are occasionally placed in this category.

Native or elemental copper is commonly found in the oxidized zone of most of the principal copper deposits of the world, but usually in small quantities. In contrast to this usual occurrence, the great native copper deposits of the Lake Superior region in Michigan are now believed to be of hypogene origin. The deposits of the Lake Superior district and Corocoro, Bolivia, are the only ones of economic importance in which elemental copper is the chief ore mineral.

The copper minerals found most frequently at the surface are the green and blue copper carbonates and the green silicates. These colors are distinctive; however, a rock with a very small percentage of copper may be colored green. Cuprite, tenorite, native copper, atacamite, chalcanthite, and occasionally other rare copper minerals are found in outcrops; these minerals together with the carbonates and silicate minerals, are usually formed by the weathering of copper sulfides. Chalcopy-

rite and, to a smaller extent, bornite may exist in outcrops or in float, but when found at the surface in arid districts usually are in the form of kernels surrounded by alteration products.

PROSPECTING AND EXPLORATION

Surface prospecting often based on the distinctive coloration due to weathering of copper minerals is the method by which most of the world's present copper mines were discovered. However, the exploration responsible for the expansion of many mines to present day capacities resulted from costly geologic and geophysical investigations, exploratory drilling and underground workings.

Tracing float, trenching and test pitting are the usual surface prospecting methods used. Search for copper minerals that do not outcrop and lie at considerable depth is done by geophysical methods, drilling or shaft sinking. Geophysical prospecting utilizes the gravimetric, magnetic, electric, seismic and thermic properties of rocks and minerals, natural to the ground tested, or produced artificially. Geophysical surveys provided information that encouraged development of two outstanding deposits: (1) Pima mine in Arizona where the ore body lays beneath 200 feet of valley fill and (2) the buried Sherritt Gordon Lynn Lake nickel-copper deposit in Canada. Gravity surveys in an underground copper mine at Bisbee, Arizona partly supplanted exploratory crosscutting and diamond drilling.

Initial exploration to define limits and boundaries and show the importance of newly found deposits is usually accomplished by drilling. Three principal types of drills are employed; churn drills, core drills, and hammer or percussion drills. Diamond drilling is most widely used in exploration because of its speed, adaptability for directional drilling, and core recovery.

MINING

Both open-pit (or open-cut) and underground methods are used in mining various types of copper ore deposits. The choice of method depends on the size, grade, and depth of the ore body and relative mining costs for the required output. Open-pit mining is the most profitable method of exploiting thin flat beds of ore with shallow cover. Large bedlike masses and ore bodies with widely disseminated mineralization (known as porphyry ore) are mined by the open-pit power-shovel method if they lie close enough to the surface so the cost of removing the overburden is not excessive. If the overburden-to-ore ratio is too high, these deposits usually are mined by underground caving systems designed for low-cost mass production. An open-pit copper mine is shown in figure 1.

The general features of open-pit mining appear simple but good management and systematic work are essential. The shape and position of the ore body must be predetermined to allow planning of stripping disposal, approaches, benching design, pit slope, transportation, equipment and other necessities to promote handling a maximum amount of ore and waste. The advantages of the open-pit are: (1) The ease with which mine production can be increased or decreased; (2) the ease with which the mine can be shut down or started up; (3) more selectivity in mining; and (4) complete extraction of the ore. Drilling, blasting, loading, and transportation constitute the cycle of open-pit ore extraction, and improvements of all operations are problems of constant research. Recent advances include the use of rotary drills instead of churn drills for blast-hole drilling; use of the lower cost fertilizer grade ammonia nitrate explosive; the trend toward larger shovel dippers and larger trucks; and the installation at some mines of inclined belt conveyors and skips to remove ore from the pits.

A substantial portion of the world's copper production is mined from deep deposits by underground methods, other than block caving, which are adaptable to maximum extraction of ore from the various types of ore bodies with the greatest safety and at minimum cost. Most of the common underground methods, (square set, fill, shrinkage, top slicing, sublevel caving, cut and fill, long-hole, room and pillar, etc.) with variations are used in mining copper ores. Ore handling systems at large mines are almost completely mechanized and great tonnages of ore are moved at low cost with a minimum of labor. Advancements have been made in lowering transportation and other costs in some mines, making it possible to mine ore bodies or portions of ore bodies not considered economically recoverable a few years ago. Improved drilling equipment, muckers, slushers, haulage equipment, and underground conveyors have increased efficiencies at many copper mines. In some, transportation on haulage levels is controlled by a dispatcher who transmits messages to motormen over a mine telephone or radio system. Intercommunication among motor operators is possible, preventing collisions and delays. One way traffic underground is a recent development contributing to reduction of accidents and efficiency in mine haulage.

The growth of open-pit mining since 1939 is shown in figure 2. In the United States

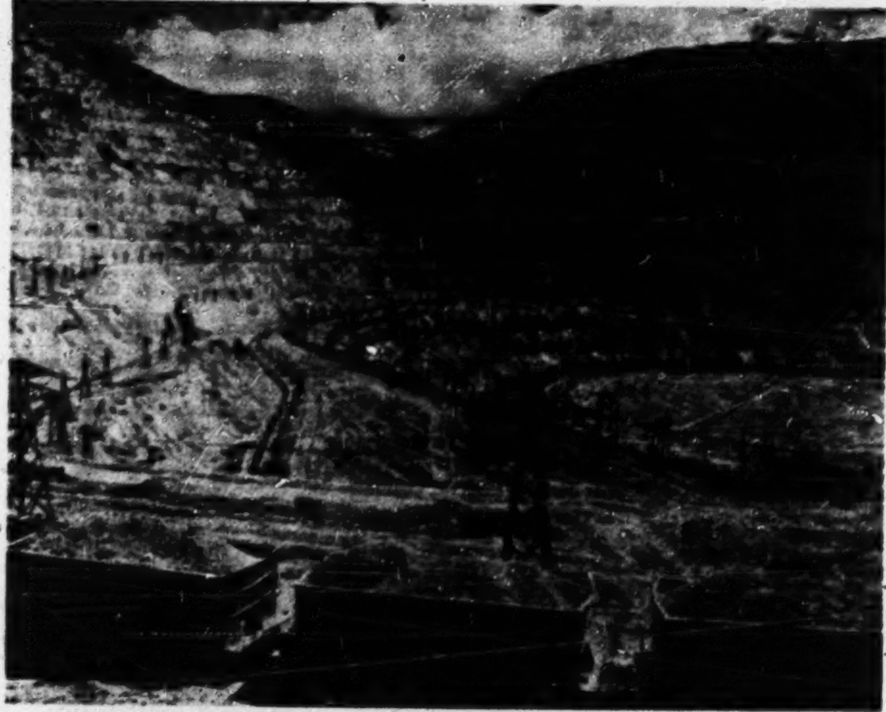

FIGURE 1.—An Open Pit Copper Mine. (Courtesy Kennecott Copper Corp.)

open-pit mining in 1958 accounted for 76 percent of the ore mined and 71 percent of the copper produced. The block-caving operation at San Manuel and the White Pine Copper Co.'s room-and-pillar system account for the slight percentage increase in production from underground mines since 1955.

BENEFICIATION

Processing sulfide ores of copper now provides and, in the foreseeable future, will continue to provide the bulk of the copper produced. The concentrators treating sulfide ores follow similar flowsheets employing crushing, grinding, classifying, flotation, thickening, and filtering (figure 3).

The flotation process for separating copper sulfide minerals from gangue material is far advanced and is used universally except at some small operations, which may employ gravity concentration using jigs or vibrating tables. Large concentrators following good milling practice recover about 90 percent of the copper in the concentrate. The typical copper concentrate, in the United States, contains 25 to 30 percent copper and sometimes gold, silver, molybdenum, and selenium.

Recovery of copper carbonate minerals, either alone or together with copper sulfides by sulfidation and zanthate flotation has been achieved with a certain degree of success, but flotation of the silicate minerals, dioptase and chrysocolla, remains to be solved. Numerous procedures for floating silicates have been reported, but the processes are uneconomic.

LEACHING

Approximately 9 percent of the U.S. production of copper is by hydrometallurgical methods. Leaching followed by cementation or electrolysis is the process used to recover copper from ores containing copper oxide minerals.

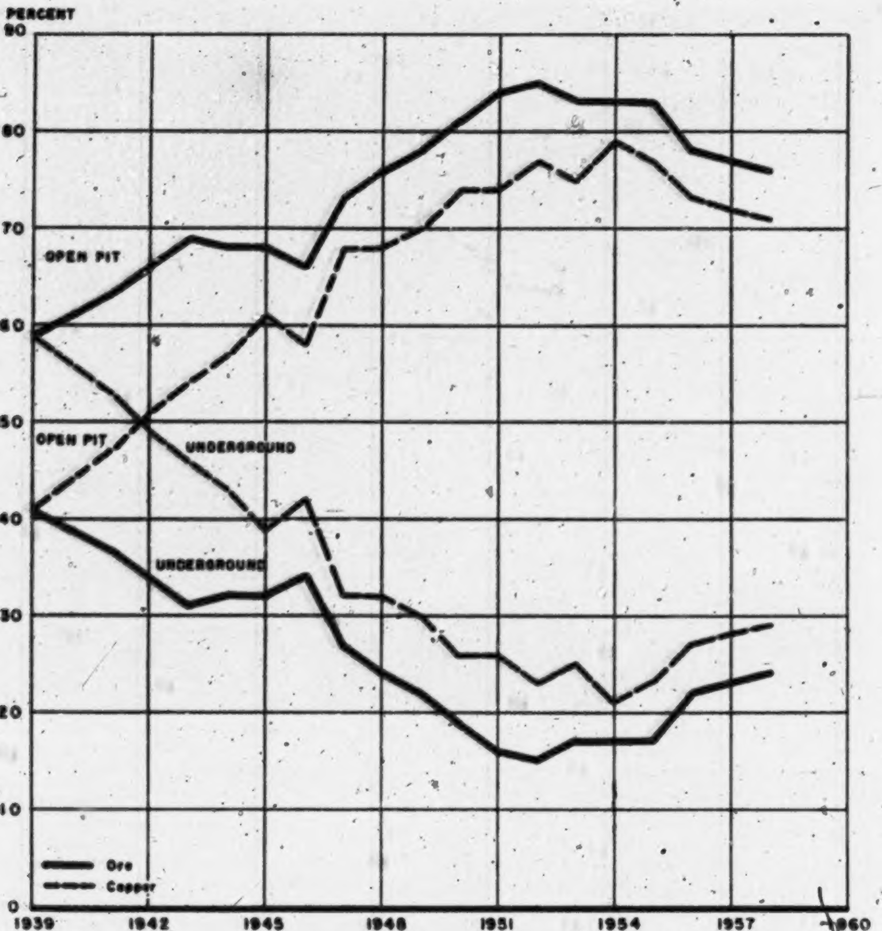

FIGURE 2.—Growth of Open-Pit Mining.

Oxidized copper minerals, such as the carbonates and silicates are readily attacked and the copper dissolved by a number of the more common acids and alkalies; the copper is precipitated from solution by electrolysis or by iron replacement of the copper, and in the case of ammonia leaching by simply boiling off the ammonia. The usual practice is to leach the ore with dilute sulfuric acid followed by recovery of the copper by cementation on scrap iron.

Leaching of mixed oxide-sulfide ores is more difficult. Ferric sulfate is an active solvent of most oxidized copper minerals and to an extent is effective on free copper sulfides. Complete extraction is possible on oxides and carbonates in comparatively short periods while sulfides are more slowly acted upon. To overcome the resistance of double sulfides, such as chalcopyrite and bornite, to this reagent, controlled roasting prior to leaching allows com-

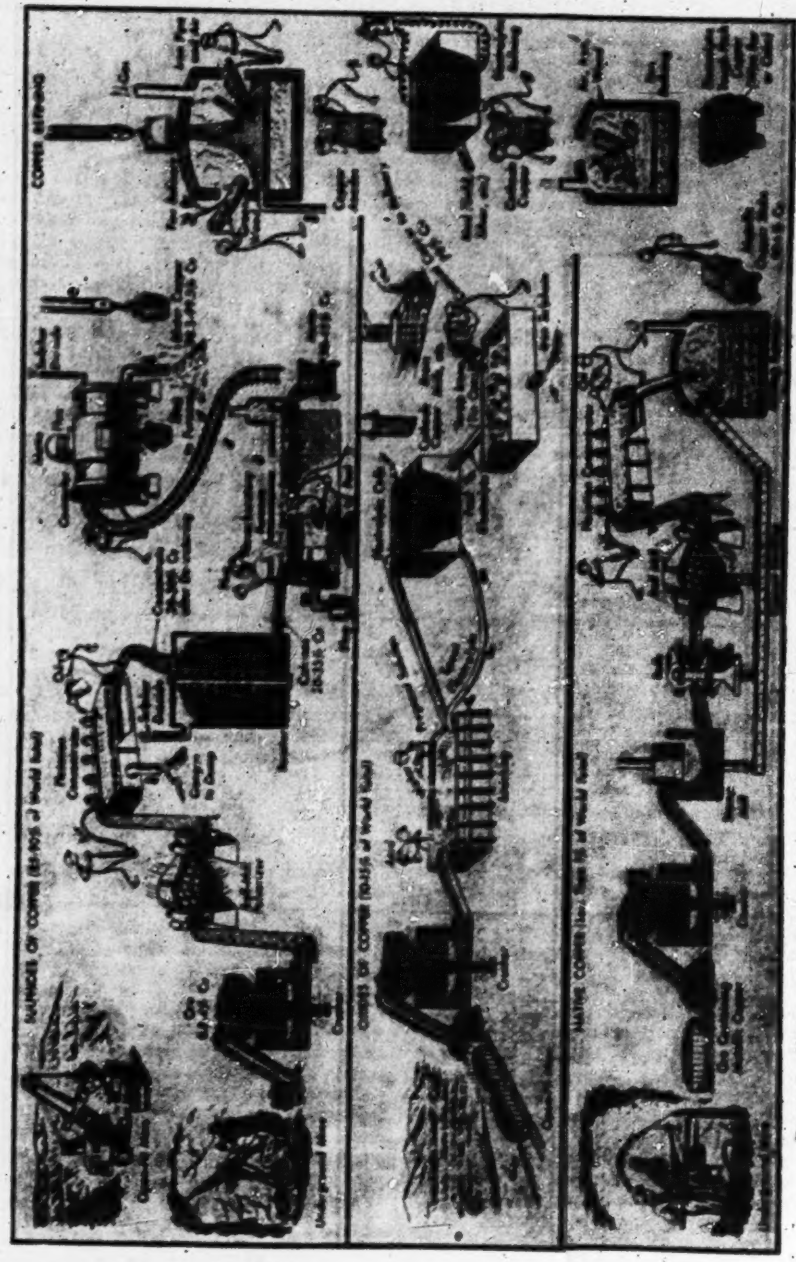

FIGURE 3.—Mining and Metallurgical Treatment of Sulphide, Oxide, and Native Copper Ores. (Courtesy Westinghouse Engineer)

mercial extraction. Acid-ferric sulfate leaching of mixed oxide-sulfide ores followed by electrowinning was for years standard practice by the Inspiration Copper Co. in Arizona, but recently the dual metallurgy process involving leaching followed by flotation concentration was begün. In this process leaching dissolves the recoverable oxide content of the ore, and part of the sulfide content. The washed and drained residue from this operation is then treated by flotation concentration to win the remainder of the recoverable sulfide copper content. Leach-precipitation-flotation of mixed ores has been employed on a commercial scale at one mill in Arizona and by The Anaconda Co. in Montana.

SMELTING AND REFINING

The smelting of sulfide copper ores or concentrates involves three major steps—roasting, reverberatory furnacing, and converting. Roasting removes a portion of the sulfur, as well as some of the volatile components like arsenic, antimony, and bismuth, and oxidizes some of the iron to ferrous oxide. Reverberatory smelting of the roasted material to copper matte is based on the strong affinity of copper and sulfur for each other, as compared with that of other metals and sulfur, and the relatively weaker affinity of copper for oxygen. In a reducing or neutral atmosphere and at smelting temperatures, copper and sulfur form the stable cuprous sulfide, Cu_2S. Excess sulfur, under reducing conditions, unites with iron to form a correspondingly stable ferrous sulfide, FeS. Cuprous sulfide and ferrous sulfide are miscible in all proportions in the liquid state. In the solid state they form an eutectic. The mixture whether liquid or solid, is known as copper matte. Excess iron, usually in the form of ferrous oxide, FeO, combines with silica and enters the slag as ferrous silicate.

The matte formed in the reverberatory furnace is transferred to a refractory lined vessel, known as a converter, where thin streams of air are forced through the molten mass. The rapid oxidation reaction converts the copper sulfide to copper and sulfur dioxide.

The iron sulfide of the matte reacts with the oxygen of the air to form iron oxide that combines with charged silica flux to form the converter slag. This slag contains appreciable copper and is returned and charged to the reverberatory furnace. The molten copper metal is transferred from the converter into a holding furnace from which it is cast as blister copper in anode slabs or cakes.

Furnace or fire refining of blister copper consists of oxidation, fluxing and reduction. The basis of this operation is the weak affinity of copper for oxygen as contrasted to that of the impurities. The practice is to introduce compressed air into the molten metal at 8 to 10 pounds pressure through iron pipes; metallic oxides of the impurities are formed that combine with added silica to form slag. The slag is skimmed continuously during the oxidizing period until no more slag forms and liquid cuprous oxide, Cu_2O, begins to form on the bath. Reduction of the cuprous oxide is accomplished by stirring the bath with green wooden poles. The reducing gases formed (CO, H_2 and hydrocarbons) by destructive distillation of the wood reduce the Cu_2O to metallic copper. The order in which impurities in copper are removed by oxidation in fire-refining methods is: Sulfur, zinc, tin, and iron. Lead, arsenic, and antimony in large quantities can be eliminated by fluxing. Some impurities, such as nickel, bismuth, selenium, and tellurium resist fire-refining treatments almost completely.

Electrolytic refining of copper is based on the selective action of the electric current. A copper anode and a cathode starting sheet are suspended in an electrolyte composed of copper sulfate and sulfuric acid. The copper dissolves from the anode and is deposited on the cathode. Most of the usual impurities such as gold, silver, platinum, and palladium precipitate out of solution and form anode mud which accumulates at the bottom of the electrolytic cell; others dissolve and become concentrated in the electrolyte and may be deposited or occluded on the cathode. Cathode copper has a minimum purity of 99.90 percent.

USES AND PROPERTIES

Copper has numerous valuable properties that, individually or in combination, give it a wide variety of uses. The properties of major significance are high electrical and thermal conductivity, ductility, malleability, formability, strength, and corrosion resistance. In addition, copper has a pleasing color, is nonmagnetic, and is easily finished by plating or lacquering; it can be welded, brazed and soldered satisfactorily. When it is desirable to improve certain of these basic properties and when such an improvement can be effected without sacrificing any required qualities for

a particular application, alloying often solves the problem. As a consequence, the popular commercial brasses, bronzes, copper-nickel alloys and nickel silvers have been developed.

The use of copper and its alloys is universal. They are practically synonymous with all things electrical and have myriad uses in construction, autos, aircraft, missiles, railroad equipment, marine equipment, appliances, machinery and equipment, scientific instruments, utensils and jewelry, cladding, and many other applications.

Approximately one-half of all copper consumed is for electrical applications, including power transmission, communications, electronics, electrical equipment, transportation, and complex weapons systems. Construction (homes, plants, office buildings), power generation and transmission are the largest users. Virtually all building wiring is copper, as are lines leading from power cables. The transmission of power continues to be a major market for copper even though aluminum is now used for most overhead high voltage lines; however, copper still dominates in high voltage underground lines. Power generation requires extremely large quantities of copper. Examples are heat exchangers, windings in motors, generators and transformers, magnet wire in control apparatus, and bus bars.

For communications, telephone and telegraph wire and cable are two of the biggest markets. Hundreds of components in radio sets and telegraph receiving and sending equipment are made of copper or its alloys; and coaxial cables employ a substantial amount of copper. Copper's excellent electrical conductivity has made it the major metal used in the expanding applications of printed circuits. Radio and TV sets provide the largest market but there is a great potential for the use of printed circuits in appliances, automobile instrument panels, and electronic computers.

The noncorrosive quality of copper and its alloys accounts for many uses in construction for roofing products, plumbing goods, builder's hardware, and functional decorative applications. Sheet roofing, gutters, downspouts and heads, flashing, fittings and accessories consume a large amount of copper. Copper and red brass are found frequently in plumbing items such as, tank lever lift arms, toilet tank trim, lavatory fittings, tub fittings, faucets, traps and drains, closet tank components, flush valves, piping and tubing, and other fixtures. Brass and bronze are popular for builder's hardware because they are decorative, noncorrosive, and easy to fabricate for such items as locks, door knobs and knockers, door stops, hinges, bolts, latches, and safety hasps.

Copper consumption in the automotive industry accounts for about 8 percent of the total for the United States. Volume uses are in radiators, heaters and defrosters, air conditioning units, bearings, bushings, carburetors, generators, oil lines, strainers, wiring, switches, and plating. Major uses take sheets, plates and wire; secondary uses, rods, bars, and foundry products. The average 1958 and 1959 autos consumed 40 to 50 pounds of copper.

For aircraft the maze of wiring in a plane's electrical system takes more copper than any other use in this industry. Some of the larger planes use from 600 to almost 3,000 pounds of copper in the electrical systems and mechanical components.

Copper is a minor, though essential, metal in the Nation's missile program. As in aircraft, the major use is in wiring systems.

Railroads use a large quantity of copper in diesel locomotives, passenger cars, and in switching and signal devices. The average Pullman car uses almost 2,000 pounds of copper tube in the water supply system, air brakes, heating system, air conditioning unit, condensers, evaporator and heat coils.

Tankers, cargo ships, pleasure craft, passenger liners, and naval vessels take advantage of copper and its alloys in a great variety of marine equipment. Naval brass is widely used for propeller shafting (because of its strength, torque resistance, machinability, and corrosion resistance); silicon bronze for fastenings and water tanks; soft and hard drawn copper for exhaust yokes, fuel lines, water lines, and piping (resistance to corrosion and leaks, workability, long life). The Navy's nuclear submarine Skipjack uses brass in capstans, torpedo tubes, diving gear, and valves; more than 48,000 feet of copper tube in hydraulic, air, and lubricating oil lines; and over 6,000 feet of cupro-nickel tube in auxiliary cooling lines, heat exchangers, lavatories, bilge pumps, and salt water service lines.

In the appliance field, manufacturers of washing machines, air-conditioning units, refrigerators, TV sets, and other units specify copper and its alloys for many components requiring materials that are electrically or thermally conductive, corrosion resistant and durable.

Large machinery and equipment, turbines, and heat exchangers take advantage of the properties of copper or its alloys in many ways. Specific uses are copper for motors, other electrical equipment and tubing; bronze for worm wheels, oil baffles, check valves, and levers; cupro-nickel for tubing; naval brass, muntz metal, and aluminum bronze for plates, sheets, bars, and weld wire.

TABLE 2.—*Copper use pattern in 1950 (President's Materials Policy Commission Report)*

	Short tons (thousands)	Percent of total
Electrical	310	22.0
Telephone and telegraph	87	6.0
Light and power	100	7.0
Wire cloth	10	.7
Other rod and wire	127	9.0
Ammunition	70	5.0
Automobiles and trucks	145	10.3
Building	185	13.0
Clocks and watches	7	.5
Copper-bearing steel	8	.6
Radiators and heating	9	.6
Radio and television	50	3.5
Railroads	28	2.0
Refrigerators	28	2.0
Shipbuilding	23	1.6
Air conditioning	30	2.1
Others	96	6.8
Manufactured for export [1]	151	10.7
Total	1,410	100.0

[1] Comprises the copper content of all mill products and all fabricated products which were exported, but does not include any raw copper exported as such.

Copper is used extensively in watches, clocks, microscopes, projectors, and many types of gages.

Solid copper, brass, and bronze are popular materials for utensils, jewelry, furnishings, and decorative items. They are used in the manufacture of such items as: Brass and bronze medallions; solid brass furnishings, such as towel bars, curtain rods, wall hooks, and soap dishes; copper, brass, and bronze jewelry; cookware; tableware; and bronze and brass plaques and signs.

BYPRODUCTS, COPRODUCTS, RELATIONSHIPS TO OTHER COMMODITIES

About 98 percent of the U.S. mine production of copper is recovered from copper ore; and the remainder from complex ores. In addition to copper, important quantities of byproduct, gold, silver, sulfuric acid, molybdenum, selenium, arsenic, and platinum-group metals are recovered. These byproducts or coproducts may be recovered at one or more of the various steps of concentration, smelting, and refining. About 40 percent of the 41 million pounds of molybdenum produced in 1958 was recovered as a byproduct largely from copper ores; of the 682,000 pounds of selenium produced in 1958, about 600,000 pounds was recovered from the electrolytic production of copper; and 496,000 tons of sulfuric acid was produced at copper plants (includes output of a lead smelter). In the five year period 1954–58 approximately 30 percent of the United States gold production and 28 percent of the silver production were derived from the processing of copper ores. Nearly one-half of the copper output in Canada comes from ores of the Sudbury district, Ontario, mined principally for nickel, and approximately 50 percent of the world's cobalt production in 1958 came from processing Belgian Congo copper ores.

SUBSTITUTES

Aluminum is the principal alternative material for copper as an electrical conductor. Price is one of several factors that influence its partial substitution for copper. Aluminum wire with a steel core (ACSR) has displaced copper for long-distance transmission lines. Other typical substitutions of aluminum for copper are in bus bars, fractional horsepower motor windings and lightbulb bases. There has been an accelerated shift to the use of steel for brass in shell cases.

Aluminum and stainless steels have also somewhat reduced the use of copper in the building industry. Technology has furthered substitution for copper by the introduction of the numerous clad metals, including copper clad, which use proportionately less metal than would solid copper. Printed electrical circuits have also come into the field as a substitute for copper wire and plastic tubing replaces copper in some automobiles and appliances and other uses.

A study of the use of copper and aluminum in 1954 compared with 1947, for selected product groups, was made by the Business and Defense Services Administration. Some of the major groups selected show the following changes: Power transmission equipment, copper rose 92 percent and aluminum 310 percent; radio and radio products, copper rose 74 percent and aluminum 261; engine electrical equipment, copper rose 39 percent and aluminum 556; metal stampings, copper dropped 27 percent while aluminum rose 25; telephone and telegraph equipment, copper dropped 11 percent while aluminum rose 170, and the grand total for all industrial groups, copper dropped 14 percent as aluminum rose 103 percent.

Adjustment to the new competing materials does not involve much more than a shift in the overall consumption pattern. It will make more copper available for those uses for which it is peculiarly fitted and for which substitutes are impracticable.

SECONDARY SOURCES AND RECOVERY

Secondary copper is that copper recovered from copper scrap, copper-alloy scrap, and other copper-bearing scrap materials as copper metal, as copper alloys without separation of the copper, or as copper compounds.[4] Second-

ary copper is produced from new and old scrap, the two general classes of scrap copper.

New scrap is generated in manufacturing articles from primary or refined metal and consumed at a plant of different location from the plant of generation. Typical types of new scrap are defective finished or semifinished articles, clippings, punchings, turnings, borings, skimmings, drosses, and slag. New scrap consumed in the plant of generation is called *runaround* or *home* scrap.

Old scrap consists of articles that have been discarded after serving a useful purpose. Such articles may be worn out, obsolete, or damaged, and include discarded trolley wire, radiators, fired cartridge cases, used pipe, and lithographers' plates. Old scrap is largely collected by several thousand scrap dealers, who, for the most part, are unaffiliated with the primary copper producers.

The channels through which much of the reclaimed copper returns from the scrap dealers and fabricators to use are the secondary refiners, the brass and bronze ingot makers, and the brass mills.

Total secondary-copper production increased markedly during the past 25 years. From an average yearly recovery of 436,000 tons in 1933–37, output rose to 609,000 tons a year in 1938–42, and to 962,000 tons in 1943–47. In the 1948–52 period it dropped to 900,000 tons, and in the last 5-year period (1954–58) to 880,000 tons. Most of the secondary copper is recovered in ingot brass and bronze and other alloys; recovery of scrap as unalloyed represents less than one-third of the annual total.

Copper and copper-base alloy scrap is sorted and separated into its various classifications. The separation is made on the basis of color, hardness, magnetic properties, type of fabrication, reaction to acids and other reagents, and original source. Brass scrap is sorted piece by piece. Like materials are grouped, assayed, and stored according to composition and metallic content. Furnace charges are made up of weighted amounts of one or more types of scrap that will closely approximate the desired composition of the alloy to be cast. After the charge has been melted a sample of the bath is taken and refining, consisting of fluxing, oxidation and slagging is started. After refining calculated additions of virgin metals are made to adjust the analysis of the melt to specifications and the heat is tapped and poured into ingots.

A substantial quantity of clean copper scrap is remelted, cast into anodes and electrolytically refined. Other copper scrap is charged to reverberatories at primary smelters and is recovered as electrolytic or fire refined copper.

TABLE 3.—*Secondary copper produced in the United States*

[Short tons]

	1949–53 (average)	1954	1955	1956	1957	1958
Copper recovered as unalloyed copper	[illegible]	212,241	[illegible]	[illegible]	[illegible]	[illegible]
Copper recovered in alloys [1]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total secondary scrap	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
From new scrap	[illegible]	[illegible]	474,419	[illegible]	[illegible]	[illegible]
From old scrap	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Percentage equivalent of domestic mine output	101	101	99	94	77	81

[1] Includes copper in chemicals, as follows: 1949–53 (average), [illegible]; 1954, [illegible]; 1955, [illegible]; 1956, [illegible]; 1957, [illegible]; 1958, [illegible].

RESERVES

Copper occurs widely but the five principal producing areas contain 93 percent of the world measured and indicated reserve. These are: (1) Chile and Peru, (2) Western United States, (3) Northern Rhodesia and Belgian Congo, (4) U.S.S.R. and (5) Canada. The measured and indicated world reserve is estimated, in terms of metal content, at 170 million tons of copper. The estimates are based on the assumption that the cost-price ratio will be such as to permit the mining of ore having approximately the same grade as that which is now being produced.

Chile has the largest reserve with 46 million tons, followed in order by the United States (32.5 million), Northern Rhodesia (24.5 million), Belgian Congo (20 million), Soviet Bloc (16 million), Peru (12.5 million), and Canada (7 million). Substantial orebodies make up the smaller reserves of Yugoslavia (1.2 million), Union of South Africa and South-West Africa (1.1 million), Australia (1 million), Philippines (1 million); Mexico (750,000), Turkey (500,000), and Cyprus (200,000). Cuba, Bolivia, Finland, Norway, Spain, Sweden, India, Japan, and other countries account for an estimated additional 6 million tons of recoverable copper. There are substantial inferred reserves that will likely develop into measured or indicated ore upon extension of present mine workings and delin-

cation of new deposits by planned expansion and exploration projects.

The United States has a reserve of recoverable copper-in-use estimated to be about 30 million tons.

CONSERVATION

Mining and metallurgical research leading to more economic extraction and beneficiation of copper ores have made immense tonnages of ore available which otherwise would have been of no value as a source of copper. The need for lower costs, in turn, has encouraged research for the development of more efficient methods and techniques at all levels in the production of copper and copper products.

One of the most effective conservation practices is the reclamation of copper from scrap that provides approximately one-fourth of the U.S. supply.

SOURCES OF STATISTICAL INFORMATION

Monthly and annual data on mine production of recoverable copper are reported by producers to the Federal Bureau of Mines; monthly data on production of blister copper, refined copper by shapes, stocks of blister, refined and unrefined copper are reported by the primary smelting and refining companies. Primary copper plants and chemical plants report stocks, production, consumption, and shipments of copper sulfate monthly, and copper smelters report production of byproduct sulfuric acid annually. Sales of copper by copper selling agencies are reported annually.

Consumption of refined copper by major industry classes is reported monthly. Consumption of scrap by types, by primary copper producers, secondary smelters and brass mills is reported monthly. Other consumption data collected annually include consumption of brass and bronze ingot by foundries, and refined copper and scrap at foundries, miscellaneous manufacturers and chemical plants. The domestic data collected are sufficiently adequate and accurate for current programming and planning.

World mine and smelter production data are compiled by the Bureau's Division of Foreign Activities. U.S. imports and exports of copper are obtained by the Bureau of the Census.

There are no data on consumption of copper by end uses or by geographic locations. Also lacking are adequate consumption data outside the United States.

PRODUCTION, CONSUMPTION, AND FOREIGN TRADE

PRODUCTION

World mine production of copper has increased without interruption since 1950, and output of 3.9 million tons in 1957 established a world-production record. The increased rates were due mainly to output from new properties and stepped-up production at many established mines encouraged by the highest prices in 90 years.

The United States is the largest copper-producing country in the world and has been for many years (figure 4 on p. 18). The United States lost this position only once since 1883, when Chile outranked it in the depression year 1934. In the most recent 10-year period (1949–58) the United States produced 29 percent of the world output. Chile usually ranks second among leading copper-producing countries, however, in 1953 and 1954 it was surpassed by Northern Rhodesia. Six countries each averaged in excess of 250,000 tons annually in the last 5 years as follows, in thousands of tons: United States 1,001; Chile 493; Northern Rhodesia 440; U.S.S.R. 421; Canada 338; and Belgian Congo 261. Comparable data in the previous 5-year period, 1949–53, were: United States 888; Chile 416; Northern Rhodesia 347; U.S.S.R. 280; Canada 262; and Belgian Congo 205.

TABLE 4.—*Supply and distribution of copper in the United States*

[Thousand short tons]

Year	Supply: Production: Primary: Domestic materials	Supply: Production: Primary: Foreign materials	Supply: Production: Secondary (old scrap)	Supply: Imports (refined)	Supply: Total	Distribution: Consumption: Refined	Distribution: Consumption: Secondary in alloys	Distribution: Exports (refined)	Distribution: Total
1949–53 (average)	[illegible]	[illegible]	434	291	[illegible]	[illegible]	[illegible]	140	[illegible]
1954	842	[illegible]	[illegible]	313	1,834	1,250	[illegible]	216	[illegible]
1955	[illegible]	[illegible]	315	[illegible]	[illegible]	[illegible]	414	[illegible]	[illegible]
1956	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,513	318	[illegible]	[illegible]
1957	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	311	[illegible]	[illegible]
1958	1,002	351	411	128	[illegible]	1,361	[illegible]	[illegible]	1,904

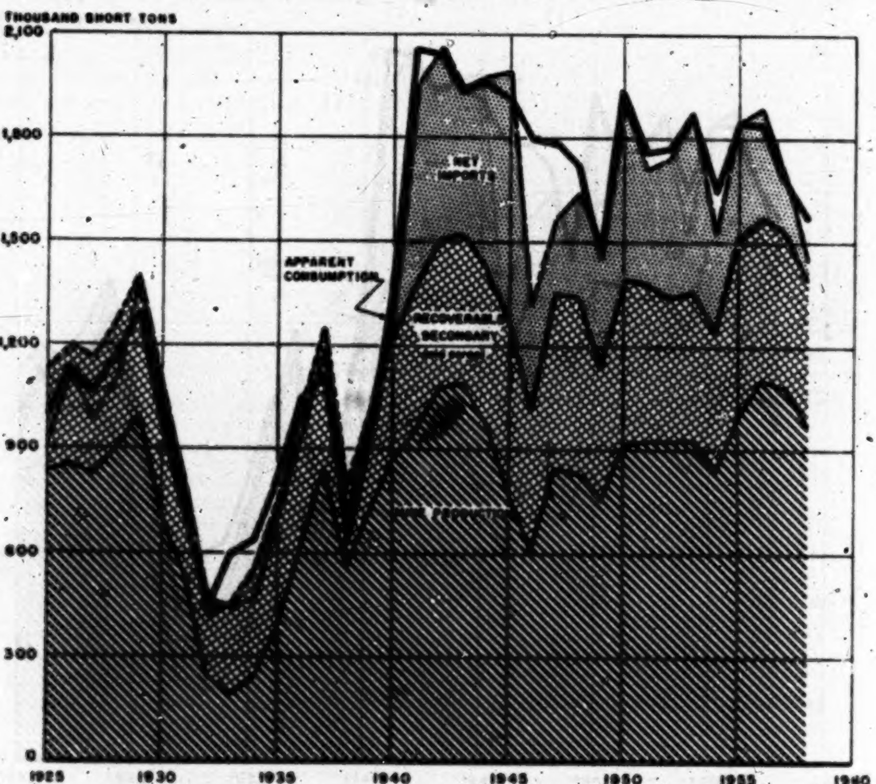

FIGURE 4.—Salient Statistics of the Copper Industry of the United States, 1925–58.

The shortage of copper supply that existed for most of the period from the beginning of World War II was reversed in 1956. More than enough copper became available and to reduce the oversupply many producers curtailed production beginning in October 1956. Reductions continued throughout 1957 and into 1958. Demand for copper turned upward about mid-1958, and in the late months of the year production schedules in the United States and abroad were stepped up to meet the increasing demand.

CONSUMPTION

Over the period 1948 to 1958 the annual consumption of copper in the world increased (according to data compiled by the American Bureau of Metal Statistics) from 2,764,000 tons in 1948 to 4,091,000 tons in 1958. This increase of about 50 percent was due to the demand for copper necessary for rehabilitation and rebuilding of industries in the war stricken countries of Europe, growth of industry in underdeveloped countries, and expansion of industrial activity in others. Except for 1949 and 1953 world consumption made significant advances each year. Although the United States maintained its status as the largest copper consuming country as it had since the turn of the century, its percentage of world demand dropped approximately 40 percent. Consumption in the United States during the last decade advanced 9 percent to the alltime peace time high in 1956, then declined 20 percent due to the recession in 1957 and 1958.

The consumption of refined copper, by broad industry classifications, is shown in table 8. There are no recent continuing statistical data

TABLE 5.—*Mine production of recoverable copper in the United States, by States*

[Short tons]

State	1949-53 (average)	1954	1955	1956	1957	1958
Alaska	2	4	1	(1)	(1)	5
Arizona	[illegible]	377,927	484,108	[illegible]	[illegible]	[illegible]
California	[illegible]	[illegible]	613	[illegible]	943	749
Colorado	3,681	4,823	4,323	4,228	5,115	4,198
Idaho	2,411	[illegible]	5,616	[illegible]	7,912	[illegible]
Michigan	23,178	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Missouri	[illegible]	1,925	1,722	[illegible]	1,604	[illegible]
Montana	61,612	[illegible]	[illegible]	[illegible]	91,812	[illegible]
Nevada	[illegible]	70,217	[illegible]	[illegible]	77,780	[illegible]
New Mexico	[illegible]	[illegible]	[illegible]	74,345	67,472	[illegible]
Oregon	12	5	4	7	23	10
Pennsylvania [2]	[illegible]	3,270	4,110	4,102	7,516	[illegible]
Tennessee	7,171	[illegible]	[illegible]	10,440	[illegible]	[illegible]
Texas	9		1			
Utah	[illegible]	231,[illegible]	[illegible]	[illegible]	257,857	186,184
Vermont	[illegible]	[illegible]	4,306	[illegible]	[illegible]	478
Washington	[illegible]	[illegible]	[illegible]	[illegible]	1,770	83
Wyoming		1		3	4	(1)
Total	[illegible]	[illegible]	998,570	1,104,156	1,086,[illegible]	979,329

[1] Less than ½ ton.
[2] Includes North Carolina.

TABLE 6.—*World mine production of copper, by countries*

[Short tons]

Country	1949-53 (average)	1954	1955	1956	1957	1958
Australia	22,748	45,760	[illegible]	[illegible]	[illegible]	[illegible]
Belgian Congo [1]	204,848	242,424	[illegible]	[illegible]	267,025	[illegible]
Canada	261,735	[illegible]	[illegible]	[illegible]	[illegible] 100	[illegible]
Chile	414,928	[illegible]	477,873	[illegible]	[illegible]	[illegible]
Cyprus (exports)	26,140	30,000	[illegible]	[illegible]	44,676	36,614
Finland	[illegible]	22,150	22,700	22,180	25,700	[illegible]
Germany: East	12,000	[illegible]	22,100	[illegible]	24,300	24,300
Japan	50,156	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mexico	67,220	60,413	[illegible]	[illegible]	[illegible]	71,[illegible]
Peru	34,421	42,[illegible]	47,844	[illegible]	[illegible]	[illegible]
Philippines	12,389	15,817	18,367	[illegible]	44,512	51,542
Rhodesia and Nyasaland, Federation of: Northern Rhodesia	367,913	[illegible]	[illegible]	[illegible]	[illegible]	441,073
South-West Africa	13,024	[illegible]	[illegible]	[illegible]	30,910	30,978
Sweden	16,907	14,[illegible]	17,278	18,436	19,934	[illegible]
Turkey [1]	18,377	27,042	26,224	27,307	[illegible]	[illegible]
Union of South Africa	37,[illegible]	[illegible]	[illegible]	51,232	[illegible]	54,615
U.S.S.R. [1]	[illegible]	[illegible]	[illegible]	420,000	470,000	470,000
United States	[illegible]	[illegible]	998,570	1,104,156	1,086,[illegible]	979,329
Yugoslavia [1]	37,[illegible]	[illegible]	31,181	[illegible]	37,186	37,117
Other countries	75,000	87,000	98,000	[illegible]	110,000	116,000
World total (estimate)	2,820,000	3,110,000	3,410,000	3,780,000	3,900,000	3,740,000

[1] Smelter production.

showing the consumption of copper by end uses. However, quantities of copper used in 1950 for certain products and industries estimated by an industry representative for the President's Materials Policy Commission are shown in table 2.

FOREIGN TRADE

Before World War II U.S. imports and exports of copper constituted a well-balanced trade through which the smelting, refining, and fabricating facilities of this country were used to treat foreign crude materials and to return refined copper and manufactures of copper abroad. After the beginning of the war the United States needed all the copper that entered the country to supply new peak consumption needs. In the postwar period demand continued above prewar levels to fill postponed civilian requirements; as a result the United States had remained partially dependent on imported material.

The alltime record receipts of foreign materials was made in 1945 when 853,000 tons of copper in all forms was received; a record quantity of refined copper (530,000) tons also was received in 1945. From 1954 through 1958, 41 percent of the refined and unrefined copper imported came from Chile, 18 percent from Canada, 9 percent from Mexico, 8 percent from the Federation of Rhodesia and Nyasaland, and 6 percent from Peru; 47 percent was in the form of blister and other unrefined materials, 31 percent in refined form, and 20 percent was ores and concentrates.

Most of the copper exported from the United States is refined copper and in advanced forms

TABLE 7.—*World smelter production of copper, by countries*

[Short tons]

Country	1949-53 (average)	1954	1955	1956	1957	1958
Australia	21,308	42,613	41,082	54,914	58,965	72,391
Belgian Congo	214,845	243,434	260,161	275,838	267,028	262,054
Canada	229,606	252,365	290,997	325,455	322,840	329,755
Chile	381,7[illegible]	372,818	447,292	508,356	496,730	482,143
Finland	19,347	23,331	24,383	24,767	28,440	32,873
Germany:						
East	21,300	28,000	30,000	33,000	33,000	33,000
West [1]	209,965	238,271	265,306	279,463	279,231	285,009
Japan	81,366	75,914	90,333	101,946	120,013	113,967
Mexico	57,437	65,327	49,731	62,080	62,061	67,109
Norway	10,427	14,210	15,142	17,013	17,357	19,261
Peru	24,326	29,178	34,862	35,806	46,137	42,292
Poland	13,200	9,000	17,300	22,400	22,000	19,180
Rhodesia and Nyasaland, Federation of: Northern Rhodesia	340,249	424,045	384,357	420,303	466,157	419,943
Sweden	18,966	18,423	19,130	18,673	21,472	22,368
Turkey	18,277	27,042	26,224	27,267	29,806	24,435
Union of South Africa	35,416	45,152	47,490	46,681	48,229	52,406
U.S.S.R.	260,000	352,000	365,600	430,000	470,000	470,000
United States [2]	955,407	945,809	1,106,526	1,201,332	1,178,145	1,060,082
Yugoslavia	37,556	33,304	31,151	32,390	37,196	37,117
Other countries	29,000	40,000	44,000	50,000	61,000	65,000
World total (estimate)	2,610,000	3,280,000	3,600,000	4,000,000	4,070,000	3,980,000

[1] Includes scrap.
[2] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1949-53 (average), 904,162; 1954, 834,261; 1955, 1,007,311; 1956, 1,117,880; 1957, 1,080,088; and 1958, 982,918.

TABLE 8.—*Refined copper consumed by classes of consumers in the United States*

[Short tons]

Year	Wire mills	Brass mills	Chemical plants	Secondary smelters	Foundries and miscellaneous	Total
1949-53 (average)	707,956	638,749	3,306	12,326	31,686	1,388,987
1954	666,601	545,645	2,329	7,434	30,720	1,254,729
1955	812,662	647,044	1,744	8,827	32,726	1,502,004
1956	864,385	611,098	1,756	7,664	36,294	1,521,209
1957	773,632	533,934	1,490	7,876	35,182	1,352,134
1958	740,276	479,510	897	7,182	22,818	1,250,677

TABLE 9.—*Copper (unmanufactured) imported into the United States, in terms of copper content* [1] *(Bureau of the Census)*

[Short tons]

Class and country	1949-53 (average)	1954	1955	1956	1957	1958
Class:						
Ores, concentrates, etc.	111,265	118,876	125,327	122,174	134,789	92,603
Blister and other unrefined	190,853	256,464	253,690	276,085	301,135	268,182
Refined	290,643	215,066	202,312	191,745	162,300	128,464
Other	12,680	4,083	12,568	5,743	5,798	7,060
Total	605,442	594,829	594,100	595,747	604,022	496,309
Country:						
Chile	287,967	295,953	238,773	236,623	234,016	200,145
Canada	61,920	88,911	107,094	120,499	120,224	74,813
Mexico	56,420	31,229	49,642	52,836	47,746	40,023
Peru	19,742	22,450	31,119	42,841	41,626	30,426
Rhodesia and Nyasaland, Federation of	55,001	61,906	73,464	27,562	45,430	35,169
Belgian Congo	1,180	13,530	14,190	12,754	10,221	15,515
Other	91,403	98,862	91,909	102,653	92,759	90,218
Total	605,443	594,829	594,100	595,747	594,022	496,309

[1] Data are "general" imports; that is, they include copper imported for immediate consumption plus material entering the country under bond.

of manufacture, in which the copper content is not calculable. Because supplies of copper in the United States have been inadequate to fill requirements in most of the period since the end of World War II, copper has been subject to export controls. During 1949-53 exports of refined copper averaged 140,000 tons annually, and ranged from 110,000 to 174,000 tons. In the 5-year period, 1954-58, inclusive, exports of refined copper rose to an average of 274,000 tons annually and ranged from 200,000 tons to 385,000. All restrictions on exports of refined copper were removed in September 1956 and shipments of such metal from the United States during 1958 rose to 385,000 tons, the highest since 1929.

TABLE 10.—*Exports of refined copper from the United States, by countries (Bureau of the Census)*

[Short tons]

Country	1949-53 (average)	1954	1955	1956	1957	1958
United Kingdom	48,226	25,347	38,062	15,808	60,640	118,652
France	23,575	60,239	64,062	60,909	54,687	91,156
Germany, West	11,354	26,326	25,251	22,930	50,773	64,631
Italy	14,503	18,051	9,559	26,159	22,536	50,547
Switzerland	7,174	10,567	8,685	15,089	14,620	11,586
Japan	343	6,841	184	20,036	46,930	8,750
Other	34,307	66,620	62,595	42,307	56,911	61,736
Total	139,482	214,061	208,819	203,102	306,033	394,903

SELF SUFFICIENCY AND STRATEGIC CONSIDERATIONS

For many years before World War II U.S. production of primary and secondary copper exceeded demand and there was a substantial surplus for export. Since then, however, roughly one-fourth of domestic needs have come from foreign sources. For the period 1954–58, domestic mine production provided 50 percent of the supply, and imports and old scrap furnished 28 and 22 percent, respectively. Projecting future demand in relation to population increase and per capita consumption and mine production capacities, the United States will continue to be dependent on foreign sources for a sizeable portion of its domestic requirements.

In the 1954–58 period, Western Hemisphere countries furnished 79 percent of U.S. imports; 41 percent came from Chile, 18 percent from Canada, 9 percent from Mexico, 6 percent from Peru, and 5 percent from other countries. Western Hemisphere production of copper is more than adequate to take care of Western Hemisphere consumption and there was an excess of more than 500,000 tons in 1958.

Mining, smelting, and refining capacities to produce copper in the United States plus the imports expected to be available in wartime from strategically accessible foreign sources and the Nation's stockpile, will provide an adequate supply of copper under anticipated emergency conditions. The development of new ore deposits and planned expansions at operating mines in Canada and South America will ensure reliable foreign sources of copper.

TABLE 11.—*United States mine production of copper, apparent consumption of new copper and excess consumption over production*

[Thousand short tons]

Period	Mine production	Apparent consumption (new)	Excess consumption over production
1920-29	7,280	6,480	[1] 860
1930-39	5,023	4,910	[1] 104
1940-49	8,796	13,642	4,846
1950	909	1,447	538
1951	928	1,304	376
1952	925	1,360	435
1953	926	1,435	509
1954	835	1,235	400
1955	999	1,336	337
1956	1,104	1,367	263
1957	1,087	1,229	132
1958	979	1,157	178

[1] Production excess.

The largest strategic use of copper has been in cartridge brass for ammunition; other ordnance items are rotating bands, bullet jackets, bearings, springs, detonators, fuse parts, and primer cups. The uses of copper and its alloys in mobile mounts, jeeps, trucks, tanks, etc., are in general the same as those for automotive applications. Likewise, the uses in field telephones, walkie-talkies, radios, radar, missiles, power generators, and distribution systems are similar to those of electrical applications in related nonstrategic items.

DEFENSE PROGRAM

Under the Defense Production Act of 1950, as amended, various types of production expansion assistance were developed for copper—production loans, government floor-price purchase contracts with escalation provisions, certificates of necessity permitting accelerated amortization of capital investment for income tax purposes, and exploration loans amounting to 50 percent of total costs repayable from eventual production. The San Manuel Copper Corp. and the White Pine Copper Co. started delivering their production to the Government under the Defense Materials Procurement Agency (DMPA) floor price contracts in the last quarter of 1957 after the price of copper had fallen to 27 cents in September. Through June 30, 1958, the Defense Minerals Exploration Administration (DMEA) had entered into 53 exploration contracts, in which copper was the major target commodity. The total estimated cost was $3,485,182 of which the Government's share was $1,742,590. Copper reserves have been developed in several areas as a result of the DMEA program.

Other defense measures were establishment of ceiling prices of copper and copper alloys

and strict export controls. Early in 1953 the situation had eased to the point where price controls and national and international allocations of copper were abandoned although military and Atomic Energy Commission needs were still to receive preferential treatment. Due to the continuing shortage of copper until the middle of 1956, quantity export controls were maintained on copper through the third quarter of 1956 and on copper scrap through the third quarter of 1957.

PRICES AND COSTS

Average annual copper prices in the United States have ranged from 5.67 cents a pound in 1932, the lowest in history, to the recent peak of 41.88 cents in 1956. Under price control during World War II and for a short period thereafter when the Government granted premiums on a quota system for copper production, February 1942–June 1947, the average price including all premiums was 14.3 cents a pound. Government regulation of prices following the outbreak of war in Korea established a ceiling of 24.5 cents a pound on January 26, 1951 which lasted until copper prices were decontrolled February 25, 1953. Labor strikes in the latter half of 1954 and increasing consumption of copper both in the United States and Europe resulted in a shortage of copper, and the price rose continually reaching 46 cents a pound on February 21, 1956, the highest in 90 years. Supply surpassed demand in the United States early in 1956 and the first reduction in price in more than 2 years was made in July of that year. A continuing high rate of production and declining consumption resulted in increasing stocks and the price of copper declined gradually until it reached a low of 25 cents a pound in January 1958. The price was raised to 26½ cents in July and to 29 cents in October reflecting effective overall reduction of mine production, a diminishing surplus, and an increasing market.

TABLE 12.—*Average prices of electrolytic copper*

[Cents per pound]

Year	Domestic f.o.b. refinery [1]	Domestic f.o.b. refinery [2]	Domestic copper delivered
1949	19.20	19.202	[3] 19.7
1950	21.46	21.235	[3] 20.8
1951	24.37	24.200	[4] 24.2
1952	24.37	24.200	[4] 24.2
1953	28.92	28.798	[4] 28.7
1954	29.82	29.694	29.5
1955	37.39	37.491	37.2
1956	41.88	41.818	42.5
1957	29.99	29.576	30.1
1958	26.13	25.764	26.3

[1] Quoted prices for domestic shipments, American Metal Market.
[2] Quoted prices for domestic shipments, E&MJ Metal and Mineral Markets.
[3] Prices for 1949–50 were f.o.b. refinery and included foreign copper delivered in United States.
[4] Prices for 1951–53 f.o.b. refinery and delivered.

Information on operational or overall costs per unit of production or of final product for mining, milling, smelting, refining, marketing, etc. is not readily available. A study by the Rhodesian Selection Trust Co., Ltd., indicated the cost of producing electrolytic copper in 1955 in the Northern Rhodesian Copperbelt was over 19 cents a pound compared with an average of about 18.25 cents a pound within the United States. An analysis of 1956 production in the United States by The Anaconda Company showed that 13.9 percent cost 30 cents a pound or more, 22.6 percent 29 cents or more and 33.1 percent 25 cents or more, leaving a balance of 66.9 percent produced under 25 cents a pound, but implying the overall average cost a pound of copper in the United States exceeded that of foreign production. Another recent statistical study arrived at a 5 year (1954–58) cost of approximately 25 cents a pound for seven domestic and foreign producing companies that accounted for 30 percent of the world's mine production.

TAXES

There are no special taxes imposed on the copper industry. Producers are granted a depletion allowance of 15 percent on domestic and foreign production.

TARIFF

An excise tax of 4 cents a pound was imposed on copper June 21, 1932. The Government was virtually the only importer in World War II, and during the period it held this position the tax was not applicable. The tax was reinstated for a very brief period, following which it was suspended by acts of Congress from April 30, 1947 to June 30, 1950. The suspended tax, meanwhile, was reduced as a result of the Trade Agreement negotiations at Geneva in 1947, to 2 cents a pound effective March 16, 1949. The 2-cent tax came into effect on July 1, 1950, but was suspended again on April 1, 1951. The law provided that the Tariff Commission must notify the President within 15 days after the end of any calendar month in which the average price dropped below 24 cents a pound, delivered Connecticut Valley, and within 20 days thereafter the President would revoke the suspension. The suspension was extended each year until 1955 when it was extended to June 30, 1958. Meanwhile, at the June 1956 meetings in Geneva on General Agreements Tariffs and Trade

(GATT), copper was subjected to certain concessions. The excise tax on copper metal, ores, nd concentrates would drop 15 percent (5 percent for each of 3 years) if the tariff were reimposed and the price of copper was not below 24 cents a pound. For fiscal 1957, 1958, and 1959, the excise tax would be 1.9, 1.8, and 1.7 cents, respectively. The latter tax became effective July 1, 1958.

RESEARCH

Prospecting and exploration by industry in recent years has resulted in the development of tremendous reserves in the major copper-producing countries. In all principal copper-producing areas in the world, ore reserves today substantially exceed those in the past. Exploratory drilling programs, in some cases supplementing geophysical and geochemical surveys, have confirmed inferred extensions of known deposits and anomalous indications of newly found occurrences. In the United States, prospecting by American Metal Climax, Inc. and Kennecott Copper Corp. found commercial deposits in Michigan; Pima Mining Co., Duval Sulfur and Potash Co., and American Smelting and Refining Co. discovered additional properties in Arizona; and The Anaconda Company outlined enough additional ore at Butte, Montana, for four extensive projects. In Chile, at Chile Exploration Co.'s Chuquicamata mine, additional oxide ore was found by drilling beyond the rim of the pit; the ore reserve at Andes Copper Co.'s El Salvador mine was increased from 80 million tons to 375 million by additional drilling and an important new discovery was made near Cabildo in Aconcagua Province. Through development research Mufulira Copper Mines, Ltd., Northern Rhodesia, have sufficient information to increase the company's copper production by 55 percent. This type of research by the mining companies is responsible for today's developed copper resources which through continuing efforts are expected to increase year by year for some time to come.

Mining equipment companies in developing more efficient earth-moving and transportation units have done much in improving efficiencies and controlling mining costs. Belt conveyors for moving ore to a central point in underground mines, as well as open pits and skip hoists instead of train or truck haulage to remove ore from open-pit mines, are recent improvements made at some properties based on equipment research.

Most segments of the industry have research facilities and men charged with experimentally investigating methods, technologies and equipment respecting their particular fields of mining, mineral dressing, leaching, smelting, refining, fabricating, foundry practice, plating and finishing and related operations. Research in procedure, and equipment for crushing, grinding, classification and flotation of copper ores has resulted in refinements that have improved recovery. In smelting, a study on the thermodynamics of the copper-iron-sulfur system at matte smelting temperatures established more accurately the region of immiscibility between matte and metal in the liquid state. Losses of metal in slag were minimized by deviating from the common practice of returning converter slag to the reverberatory furnace. A process possibility is the direct production of electrolytically refined copper and elemental sulfur from pyritic ores. The fabricating industry is widening its market research activities and improving facilities. An emphasized market research program is being carried into traditional fields such as the automotive industry as well as into such comparatively new areas as electronic computers.

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[fol. 5884] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 422

Telephone Jersey Shore 477
Central Cable Corporation

Bare and Weatherproof Wire and Cable
Copper and Aluminum

Jersey Shore, Pa.

January 26, 1955.

Mr. Alfred R. Gneiser
Aluminum Co. of America
York, Pennsylvania

Dear Mr. Gneiser:

On January 14 your office advised us of an increase in the aluminum primary metal prices, which reflected an increase on the hot rolled rods we regularly purchase from you, in an amount of one cent per pound. This price, we were advised, was effective on all orders placed after that date, and subject to change without notice.

Coincidental with the increase of the price of the rods we purchase from you, you published price sheets governing the sale of aluminum electrical conductors, which price, we were told, reflected the increased metal cost.

You will recall our several conversations in which you confirmed the reports we had received that aluminum conductor was being sold by producers at prices drastically under the published prices and, further confirmed that these prices were being offered for a stated period, specifically on a firm basis for the first half of 1955.

I am sure your principals will readily recognize the position we find ourselves placed in as a result of the activities outlined above, and our desire for a remedy allowing us to continue the production and sale of aluminum conductor. For this reason we have requested your best price on a firm basis for our requirements of aluminum rod for redrawing for the period to July 1, 1955.

We wish to assure you of our appreciation for your very good service and consideration during the long period we have been purchasing this commodity from you.

May we have your prompt reply.

Very truly yours, Central Cable Corporation, Melvin C. Harris, Vice President.

MCH:jd

Received January 27, 1955. York Office.

[fol. 5885] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 423

Copy for Mr. A. R. Gneiser, York
Noted March 4, 1955 A R G

February 14, 1955.

Received February 1, 1955 York Office

Mr. Melvin C. Harris, Vice President,
Central Cable Corporation,
Jersey Shore, Pennsylvania.

Dear Mr. Harris:

In Mr. Gneiser's absence, I am taking the liberty of replying to your letter of January 26, 1955 to him in which you request our best price on a firm basis for your requirements of aluminum redraw rod for the period of July 1, 1955. This reply has been delayed because I referred the matter to our home office in Pittsburgh to determine whether we could quote a firm price for this period and, if so, what that price should be.

I regret to inform you that we cannot quote on a firm basis. All of our sales of aluminum redraw rod are on the basis of price in effect at the time of shipment and we cannot, consistently with the law, quote you a firm price without quoting the same firm price to our other customers who

are competitors of yours. We will be very happy to receive your orders for redraw rod on the basis of our price in effect at time of shipment, and we hope that we will be able to accept all of the business which you care to place with us. We certainly would not condition any acceptance of orders [fol. 5886] upon receiving orders for your full requirements. Any such orders for ⅜ in. dia. EC-H12 or EC-H14 redraw rod, in quantities of 30,000 lbs. or more, will be priced at $.280 per lb., and as stated above, will be invoiced at our price in effect on date of shipment.

In your letter of January 26 you mentioned prices at which aluminum conductor had been sold. While I am informed by our legal counsel that a discussion of prices in past transactions is of itself permissible, the consequences of a misinterpretation of any discussion of this nature are so potentially dangerous both to us and to those with whom such discussions might be had that our company does not permit such discussions with our competitors. Therefore, I have been instructed, in accordance with company policy, not to enter into discussions of conductor prices with you.

I trust that with this explanation you will not think that this letter is at all discourteous or abrupt. Most assuredly we have been happy to serve you in the past and we hope that you will continue to favor us with your business in the future.

Very truly yours, Aluminum Company of America,
——, ——, Assistant District Sales Manager.

LCF/ac
cc—Mr. A. R. Gneiser, Aluminum Company of America, York, Pa.
cc (nico) Mr. D. B. Miller, Pittsburgh, (nico) Mr. P. T. Coffin, Pittsburgh.

[fol. 5887] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 424

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A.C.S.R.)
DeKalb, Illinois

July 1, 1957.

Mr. C. B. Owen
c/o Aluminum Company of America
520 N. Michigan Avenue
Chicago 11, Illinois

Dear Mr. Owen:

We have received the opening of the eleven bids of Tennessee Valley Authority, and have very carefully checked the prices quoted.

We received none of the orders. There were eight bidders on each inquiry and for us to be competitive with the prices quoted, we would have to purchase aluminum rods as low as 28¢ per pound. We very carefully figured our costs and material, except the aluminum, and then included a little profit. We then added the value of the aluminum to bring the total figure up to the prices quoted. In that way we arrived at what we should pay for aluminum rods—as low as 28¢ per pound and not over 30½¢ per pound.

If this condition continues we see no alternative except to produce our own aluminum rods, and we are in very good position to do so.

We are not complaining about anything; we are not even much concerned about the situation, but in all our time, the price of finished copper wire and cable never was reduced unless the price of copper went down. Now the price of aluminum cable is down as much as 5½¢ per pound below the published price sheet, on which the selling price was formerly determined, and yet the price of aluminum is no lower and we are even told the price of aluminum will advance. Another thing, aluminum cable is sold on "firm

price" and aluminum rods sold "subject to price change before shipment".

Thought we would make mention of this condition and would appreciate receiving your comments.

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMO

[fol. 5888] In United States District Court

Plaintiff's Exhibit 425

This Copy For: Mr. P. T. Coffin, Pittsburgh

July 2, 1957.

C. B. Owen
Chicago Office
Mr. D. B. Miller
Pittsburgh Office

Received May 5, 1959. Genl. Files

Re: Nehring Electrical Works, DeKalb, Illinois

July 3, 1957.

Please see the attached photostatic copy of a letter received from Mr. P. A. Nehring of Nehring Electrical Works. We thought you would be interested in seeing it. We will appreciate any comments you may have.

C. B. Owen.

CBO:jas
Att.
cc: Mr. P. T. Coffin, Pittsburgh.

[fol. 5889] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 426

July 11, 1957.

David B. Miller
Pittsburgh Office
Mr. C. B. Owen
Chicago Office

Re: Nehring Electrical Works

Attached to your letter of July 2 was Mr. Nehring's letter to you of July 1.

I would suggest that you might wish to reply to Mr. Nehring's letter somewhat along the following lines:

"Since receiving your letter of July 1, 1957 I have given a good deal of consideration to the situation which you presented. I cannot say that there is any easy solution to the problem, but I am glad to have the opportunity to comment on it.

"You recognize, I am sure, that in view of the fact our companies compete in the sale of ACSR I cannot discuss with you the pricing policies which might or ought to prevail in that industry. I can mention the historical fact, however, that Alcoa did not take the lead in what has resulted currently in substantial sales of ACSR at prices below published schedules. We have not reduced our schedule prices, but we have found it necessary to quote lower prices from time to time to meet the lower prices being quoted by our competitors.

"You raise the question of what should be done with respect to the price of redraw rod. About all I can say is that competition determines the price, whether of ACSR, redraw rod or pig. So far as our prices are concerned, we would hope to make a fair and reasonable profit on each of our products consistent with a constant endeavor to foster the [fol. 5890] further use of aluminum in all proper applications. Whether we should look solely to the selling price of ACSR in considering prices for our E.C. pig and redraw rod, or whether we should also consider the operations of our company as a whole, is perhaps a matter upon which in-

formed people might theoretically differ. We think we are following a proper procedure, taking into consideration all relevant circumstances. We may be wrong, but at least we are sincere in our belief that we are right."

David B. Miller.

DBM:dh
CC: Mr. P. T. Coffin, Pgh. Office.

[fol. 5891] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 427

This Copy For: Mr. D. B. Miller, Pittsburgh

July 15, 1957.

Mr. Paul A. Nehring
Nehring Electrical Works
De Kalb, Illinois

Dear Mr. Nehring:

Since receiving your letter of July 1, 1957 I have given a good deal of consideration to the situation which you presented. I cannot say that there is any easy solution to the problem, but I am glad to have the opportunity to comment on it.

You recognize, I am sure, that in view of the fact our companies compete in the sale of ACSR I cannot discuss with you the pricing policies which might or ought to prevail in that industry. I can mention the historical fact, however, that Alcoa did not take the lead in what has resulted currently in substantial sales of ACSR at prices below published schedules. We have not reduced our schedule prices, but we have found it necessary to quote lower prices from time to time to meet the lower prices being quoted by our competitors.

You raise the question of what should be done with respect to the pricing of redraw rod. About all I can say is that competition determines the price, whether of ACSR, redraw rod or pig. So far as our prices are concerned, we would

hope to make a fair and reasonable profit on each of our products consistent with a constant endeavor to foster the further use of aluminum in all proper applications. Whether we should look solely to the selling price of ACSR in considering prices for our E.C. pig and redraw rod, or whether we should also consider the operations of our company as a whole, is perhaps a matter upon which informed people [fol. 5892] might theoretically differ. We think we are following a proper procedure, taking into consideration all relevant circumstances. We may be wrong, but at least we are sincere in our belief that we are right.

Sincerely yours, Aluminum Company of America,
C. B. Owen.

CBO:jas
cc: Mr. D. B. Miller, Pittsburgh (nico); Mr. P. T. Coffin, Pittsburgh (nico).

[fol. 5893] In United States District Court

Plaintiff's Exhibit 428

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A. C. S. R.)
DeKalb, Illinois

July 16, 1957.

Mr. C. B. Owen
Aluminum Company of America
520 N. Michigan Avenue
Chicago 11, Illinois

Dear Mr. Owen:

Thank you for your letter of July 15th in reply to ours of July 1st wherein mention was made about the sale of ACSR up to 5½¢ below the published sheet on which we used to base our selling prices.

As mentioned previously, the price of rods has not been reduced, yet the price of aluminum rods went up when the

price of copper advanced, but has not come down with the price of copper which has lowered from 16¢ to 26¢ per pound in different parts of the world.

* * * * * * *

We have had customers tell us that they are told there is so much profit from the pig to the rod that they can cut the price of cable, but who is going to keep the price of cable down if and when there should be greater demand for cable? It looks as though that's going to be up to the independent manufacturers with aluminum from Canada.

As I stated before, I never saw such a condition in all my time in the manufacture of electrical conductor. We are not trying to bring about any change or asking for any help for we are organized to shut down if need be rather than keep operating; however, I predict if this condition does not change, there will be a complaint to the Department of Justice and I have heard there is such a move underway at present.

We mailed you an order for rods yesterday but rightfully and truthfully under these present conditions, I believe we should get all our rods from Canada or from an independent manufacturer.

With kindest regards and best wishes, we remain,

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMD

What's the connection? P.T.C.

[fol. 5894] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 429

This Copy for: Mr. P. T. Coffin, Pittsburgh

July 17, 1957.

C. B. Owen
Chicago Office
Mr. D. B. Miller
Pittsburgh Office

Received May 5, 1959. Genl. Files

July 18, 1957.

Re: Nehring Electrical Works, DeKalb, Illinois

Please see the attached photostatic copy of Mr. Paul A. Nehring's letter in answer to my letter of July 15, 1957, copy of which I sent to you. I will appreciate any comments you wish to forward.

C. B. Owen.

CBO:jas
cc: Mr. T. C. Jones, Chicago Sales, Mr. P. T. Coffin, Pittsburgh.

[fol. 5895] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 430

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A.C.S.R.)
DeKalb, Illinois

January 28, 1958.

Mr. J. B. Holloman
Aluminum Company of America
520 N. Michigan Avenue
Chicago, Illinois

Dear Mr. Holloman:

According to the going price of aluminum cable and for us to meet the highest price (and our cost of production should be as low as any), we should have a rod price from 4¢ to 6¢ a pound lower than the present price of aluminum rods. Therefore, you can readily see why you are not receiving rod business from us at this time.

We are operating at full capacity but entirely on copper at the present time. Just thought we would make mention of this as that is the situation with the independent manufacturer. I presume you know about the one independent manufacturer that is lining up production of aluminum with rolling mill and cabling especially for R.E.A.'s with a $50,000,000 loan from the government. We have been asked to consider an investment in this production.

There was a time many years ago when the independent manufacturers were able to put up a community rolling mill and buy their metal from other than the domestic producers, which we have been doing for two years or more. Prices are certainly all over the map. The quotations we receive on copper vary 2½¢ a pound from the highest to the lowest. There used to be about ⅛¢ to ¼¢ difference in price, that is in the 40 years the writer has experienced.

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMD

[fol. 5896] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 431

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A.C.S.R.)
DeKalb, Illinois

February 13, 1958.

Mr. J. B. Holloman
Aluminum Company of America
520 N. Michigan Avenue
Chicago, Illinois

Dear Mr. Holloman:

The New York Brokers are approaching us regarding the possibility of importing aluminum rods. Perhaps we could import pig aluminum at a lower duty and have it converted into rods. Would you be interested on such toll work?

For a long time, we have been buying imported copper as much as 2½¢ per pound below the producer's fixed price, and we have to do something about aluminum. It appears that the market is rigged against us, and we are talking plain about it.

We can have pig aluminum converted by the Properzi Process, but rather than put in such a mill ourselves, we would rather install a mill that would roll copper also.

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMD

P.S. We know of an order placed this week for aluminum cable for just about what the aluminum rods and steel core costs us.

[fol. 5897] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 432

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A.C.S.R.)
DeKalb, Illinois

February 27, 1958.

Aluminum Company of America
520 N. Michigan Ave.
Chicago 11, Illinois

Att'n. Mr. J. B. Holloman

Gentlemen:

Reference is made to your letter of the 20th which was received the day after you were here in DeKalb.

You mentioned rod business and I believe I explained to you why we have not been purchasing any rods for sometime. This is due to the spread between rods and finished aluminum cable, and the spread of about 8½¢ a pound between the ingot and rods. It is not possible for us to meet the present selling prices. What little we are running now in one machine is for stock and to use up some of the steel core wire we have here. We will see what happens later.

It is lucky for us that we are quite busy on copper at both plants. One of our good customers that is buying a half million pounds of copper from us, says he was told by one of the cable producers that they thought they would cut their price and offer contracts again before long. I wonder if he didn't refer to another "white sale".

We note what you say about your pricing policies. It looks as though about the same thing is going on in copper. The domestic producers' copper is 2½¢ a pound higher than the price from several other sources and from abroad. That is why we think we may have to use aluminum from abroad as well as copper. Doesn't it seem strange that you hear so much noise about the tremendous and wonderful production of aluminum and copper in this country, yet foreign copper

competition outstrips all of you. By the way, we must be quite a big company to be importing material with the 100 million pounds of surplus in the States. What do you think?

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMD

[fol. 5898] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 433

Nehring Electrical Works

Manufacturers of
Bare and Weatherproof Copper Wire and Cable
Aluminum Cable, Steel Reinforced (A.C.S.R.)
DeKalb, Illinois

April 17, 1959.

Mr. J. B. Holloman
Aluminum Company of America
520 N. Michigan Avenue
Chicago 11, Illinois

Dear Mr. Holloman:

We received yours of the 9th and also the 15th revising your quotation as an error had been made in the time limit.

As yet, we can buy to better advantage and have to do so because of the small spread between the price of rods and finished cable. Of course, the spread between the ingot and rods is not very large either. There is nothing we would rather do than buy locally, and we just cannot imagine a small company like ours (which we have always tried to keep small), importing material.

Yours very truly, Nehring Electrical Works, Paul A. Nehring, President.

PAN:MMD

[fol. 5899] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 434

SHIPMENTS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1/, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent o[f] Total
TOTAL INDUSTRY SHIPMENTS REPORTED TO BDSA 2/	197,328	100.00	245,870	100.00	232,454	100.00	226,503	100.00
ALUMINUM COMPANY OF AMERICA	72,199	36.6	61,080	24.8	63,742	27.4	62,960	27.8
ROME CABLE CORPORATION	3,006	1.5	4,199	1.7	3,242	1.4	2,948	1.3
TOTAL FOR ALCOA AND ROME	75,205	38.1	65,279	26.5	66,984	28.8	65,908	29.1
OTHER FIRMS:								
Anaconda Wire and Cable Company	21,202	10.7	33,308	13.5	36,479	15.7	35,853	15.8
Kaiser Aluminum and Chemical Corp. 3/	43,252	21.9	47,935	19.5	43,665	18.8	52,243	23.1
Bristol Plant of U. S. Rubber Co. 4/	1,603	0.8	1,926	0.8				
Olin Mathieson Chemical Corp.					13,005	5.6	10,084	4.5
Southern Electrical Corp. 5/	11,592	5.9	19,905	8.1				
Reynolds Metals Company	15,836	8.0	20,004	8.1	20,952	9.0	23,636	10.4
John A. Roebling's Sons 6/							107	0.0
General Cable Corp.	5,860	3.0	11,079	4.5	19,253	8.3	13,656	6.0
Essex Wire Corp. 7/	6,737	3.4	7,623	3.1	7,705	3.3	10,259	4.5
Hendrix Wire and Cable Corp.	221	0.1	252	0.1	309	0.1	356	0.2
Okonite Company 8/	588	0.3	1,313	0.5	369	0.2	110	0.0
[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	2.3

PLAINTIFF'S EXHIBIT 434

SHIPMENTS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1/, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958		1959	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
TS REPORTED TO BDSA 2/	197,328	100.00	245,870	100.00	232,454	100.00	226,503	100.00	258,218	100.00
ERICA	72,199	36.6	61,080	24.8	63,742	27.4	62,960	27.8	69,395	26.9
N	3,006	1.5	4,199	1.7	3,242	1.4	2,948	1.3	4,022	1.6
ME	75,205	38.1	65,279	26.5	66,98[illegible]	28.8	65,908	29.1	73,417	28.5
Cable Company	21,202	10.7	33,308	13.5	36,479	15.7	35,853	15.8	43,387	16.8
d Chemical Corp. 3/	43,252	21.9	47,935	19.5	43,665	18.8	52,243	23.1	49,006	19.0
U. S. Rubber Co. 4/	1,603	0.8	1,926	0.8						
emical Corp.					13,005	5.6	10,084	4.5	12,844	5.0
al Corp. 5/	11,592	5.9	19,905	8.1						
ompany	15,836	8.0	20,004	8.1	20,952	9.0	23,636	10.4	27,994	10.8
s Sons 6/							107	0.0	360	0.1
p.	5,860	3.0	11,079	4.5	19,253	8.3	13,656	6.0	16,952	6.6
7/	6,737	3.4	7,623	3.1	7,705	3.3	10,259	4.5	7,163	2.8
Cable Corp.	221	0.1	252	0.1	309	0.1	356	0.2	538	0.2
8/	588	0.3	1,313	0.5	369	0.2	110	0.0	361	0.1

	1955		1956		1957		1958	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
TOTAL INDUSTRY SHIPMENTS REPORTED TO BDSA 2/	197,328	100.00	245,870	100.00	232,454	100.00	226,503	100.00
ALUMINUM COMPANY OF AMERICA	72,199	36.6	61,080	24.8	63,742	27.4	62,960	27.8
ROME CABLE CORPORATION	3,006	1.5	4,199	1.7	3,242	1.4	2,948	1.3
TOTAL FOR ALCOA AND ROME	75,205	38.1	65,279	26.5	66,984	28.8	65,908	29.1
OTHER FIRMS:								
Anaconda Wire and Cable Company	21,202	10.7	33,308	13.5	36,479	15.7	35,853	15.8
Kaiser Aluminum and Chemical Corp. 3/	43,252	21.9	47,935	19.5	43,665	18.8	52,243	23.1
Bristol Plant of U. S. Rubber Co. 4/	1,603	0.8	1,926	0.8				
Olin Mathieson Chemical Corp.					13,005	5.6	10,084	4.5
Southern Electrical Corp. 5/	11,592	5.9	19,905	8.1				
Reynolds Metals Company	15,836	8.0	20,004	8.1	20,952	9.0	23,636	10.4
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General Cable Corp.	5,860	3.0	11,079	4.5	19,253	8.3	13,656	6.0
Essex Wire Corp. 7/	6,737	3.4	7,623	3.1	7,705	3.3	10,259	4.5
Hendrix Wire and Cable Corp.	221	0.1	252	0.1	309	0.1	356	0.2
Okonite Company 8/	588	0.3	1,313	0.5	369	0.2	110	0.0
Southwire Company	5,986	3.0	16,024	6.5	8,371	3.6	5,273	2.3
Nehring Electrical Works	4,526	2.3	5,913	2.4	4,792	2.1	1,083	0.5
Walker Brothers	506	0.3	360	0.1	411	0.2	316	0.1
Western Electric			1,800	0.7	2,500	1.1	200	0.1
Westinghouse Electric Corp. 9/			144	0.1	103	0.0		
Other Shipments Reported to BDSA 10/	4,214	2.1	13,005	5.3	7,556	3.3	7,419	3.3

	1955		1956		1957		1958		1959	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
REPORTED TO BDSA 2/	197,328	100.00	245,870	100.00	232,454	100.00	226,503	100.00	258,218	100.00
ICA	72,199	36.6	61,080	24.8	63,742	27.4	62,960	27.8	69,395	26.9
	3,006	1.5	4,199	1.7	3,242	1.4	2,948	1.3	4,022	1.6
	75,205	38.1	65,279	26.5	66,984	28.8	65,908	29.1	73,417	28.5
ble Company	21,202	10.7	33,308	13.5	36,479	15.7	35,853	15.8	43,387	16.8
Chemical Corp. 3/	43,252	21.9	47,935	19.5	43,665	18.8	52,243	23.1	49,006	19.0
S. Rubber Co. 4/	1,603	0.8	1,926	0.8						
cal Corp.					13,005	5.6	10,084	4.5	12,844	5.0
Corp. 5/	11,592	5.9	19,905	8.1						
any	15,836	8.0	20,004	8.1	20,952	9.0	23,636	10.4	27,994	10.8
ons 6/							107	0.0	360	0.1
	5,860	3.0	11,079	4.5	19,253	8.3	13,656	6.0	16,952	6.6
	6,737	3.4	7,623	3.1	7,705	3.3	10,259	4.5	7,163	2.8
le Corp.	221	0.1	252	0.1	309	0.1	356	0.2	538	0.2
	588	0.3	1,313	0.5	369	0.2	110	0.0	361	0.1
	5,986	3.0	16,024	6.5	8,371	3.6	5,273	2.3	12,135	4.7
orks	4,526	2.3	5,913	2.4	4,792	2.1	1,083	0.5	4,428	1.7
	506	0.3	360	0.1	411	0.2	316	0.1	175	0.1
			1,800	0.7	2,500	1.1	200	0.1	0	0.0
Corp. 9/			144	0.1	103	0.0				
cted to BDSA 10/	4,214	2.1	13,005	5.3	7,556	3.3	7,419	3.3	9,458	3.7

[fol. 5900]

1/ Shipments of aluminum conductor wire and cable are the sum of the shipments of aluminum wire, insulated or covered, and ACSR and aluminum cable, bare.

2/ The Business and Defense Services Administration requires reports only for months in which total shipments of aluminum products by a firm amounted to 10 thousand or more pounds. Thus the maximum amount that a firm could ship in a year and not be required to report would be under 120 thousand pounds per year of all aluminum products. Only if a firm produced only aluminum wire and cable, insulated or covered, and ACSR and aluminum cable, bare, and its shipments were spread evenly over the twelve months could it produce 120 thousand non-reportable pounds in any calendar year. In 1955, the year with the lowest industry total, 120 thousand pounds would be less than seven-hundredths of one per cent of the industry total. Individual company reports to the Department of Justice, however, show that six firms shipped more than 120 thousand pounds in one or more of these years, but did not report their shipments to BDSA. Circle Wire and Cable Corporation unreported shipments in excess of 120 thousand pounds ranged from less than one-tenth of one per cent in 1957 to less than three-tenths of one per cent of the BDSA industry total in 1959. Collyer Insulated Wire Company reported to the Department of Justice its use of aluminum wire and cable in its production of insulated products, rather than its actual shipments. Assuming that its shipments corresponded with its production, its total for 1955 and 1956 was more than 120 thousand pounds, but less than one-tenth of one per cent in 1955 and less than two-tenths of one per cent of the industry total in 1956. Continental Copper and Steel Industries, Inc. shipped less than one-tenth of one per cent in 1959. General Electric Company shipments ranged from less than two-tenths of one per cent in 1955 to less than four-tenths of one per cent of the BDSA total in 1959. Narragansett Wire Company shipped less than one-tenth of the BDSA total in 1958 and 1959. Triangle Conduit and Cable Company shipments ranged from less than two-tenths of one per cent in 1957 to less than one-tenth of one per cent of the BDSA total in 1955. The addition of these shipments to the BDSA total would change no market share by more than two-tenths of one percentage point. Percentages may not sum to 100 because of rounding of numbers.

3/ Shipments by Kaiser were estimated by subtracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies. The sources of the total shipments of all integrated companies are U. S. Department of Commerce, BDSA, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-integrated Producer, 1950-1957", May 7, 1958, p. 1, and "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers, 1954-1957", November 8, 1961, for the years 1955 through 1957 and "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-integrated Producers, 1958-1960", November 17, 1961, for the years 1958 and 1959.

4/ Acquired by Kaiser on February 11, 1957. Bristol plant shipments are included in Kaiser shipments for all of 1957 as well as 1958 and 1959.

5/ Acquired by Olin Mathieson on May 6, 1957. Southern Electrical shipments are listed as shipments by Olin for all of 1957 as well as 1958 and 1959.

6/ Roebling has been owned by Colorado Fuel and Iron Corp. since 1952. Most of the conductor wire and cable machinery of Roebling was purchased by Reynolds Metals Company in March 1961.

7/ Shipments for all years based on information supplied by Essex Wire Corporation to the Department of Justice. Essex based the figures for 1955, 1956, and 1959 on reports to BDSA, but Essex estimated shipments for some months in 1957 and 1958.

8/ The Okonite Company was acquired by Kennecott Copper Corporation on November 24, 1958.

9/ Westinghouse shipped between 10 and 50 thousand pounds in 1958, and between 50 and 100 thousand poinds in 1955 and 1959.

10/ Four other firms are known to have reported some shipments of aluminum conductor wire and cable to BDSA. Central Cable Corporation supplied the Department of Justice no information on its shipments. The American Steel and Wire Division of the United States Steel Corporation reported to BDSA in 1955, 1956, and 1957, shipments amounting to less than one-tenth of one per cent of the industry total reported to BDSA. In 1958 and 1959 this company's shipments were less than 10 thousand pounds per month and therefore not reported. The

[illegible], and its shipments were spread evenly over the twelve months could it produce 120 thousand non-reportable pounds in any calendar year. In 1955, the year with the lowest industry total, 120 thousand pounds would be less than seven-hundredths of one per cent of the industry total. Individual company reports to the Department of Justice, however, show that six firms shipped more than 120 thousand pounds in one or more of these years, but did not report their shipments to BDSA. Circle Wire and Cable Corporation unreported shipments in excess of 120 thousand pounds ranged from less than one-tenth of one per cent in 1957 to less than three-tenths of one per cent of the BDSA industry total in 1959. Collyer Insulated Wire Company reported to the Department of Justice its use of aluminum wire and cable in its production of insulated products, rather than its actual shipments. Assuming that its shipments corresponded with its production, its total for 1955 and 1956 was more than 120 thousand pounds, but less than one-tenth of one per cent in 1955 and less than two-tenths of one per cent of the industry total in 1956. Continental Copper and Steel Industries, Inc. shipped less than one-tenth of one per cent in 1959. General Electric Company shipments ranged from less than two-tenths of one per cent in 1955 to less than four-tenths of one per cent of the BDSA total in 1959. Narragansett Wire Company shipped less than one-tenth of the BDSA total in 1958 and 1959. Triangle Conduit and Cable Company shipments ranged from less than two-tenths of one per cent in 1957 to less than one-tenth of one per cent of the BDSA total in 1955. The addition of these shipments to the BDSA total would change no market share by more than two-tenths of one percentage point. Percentages may not sum to 100 because of rounding of numbers.

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6/ Roebling has been owned by Colorado Fuel and Iron Corp. since 1952. Most of the conductor wire and cable machinery of Roebling was purchased by Reynolds Metals Company in March 1961.

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Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice; total industry shipments from U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producer, 1950-1957," May 7, 1958, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954-1957," November 8, 1961, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961.

PLAINTIFF'S EXHIBIT 435

SHIPMENTS OF ACSR AND ALUMINUM CABLE, BARE, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
TOTAL INDUSTRY SHIPMENTS REPORTED TO BDSA 1/	157,237	100.0	188,282	100.0	181,701	100.0	175,157	100.0
ALUMINUM COMPANY OF AMERICA	67,850	43.2	56,161	29.8	58,964	32.5	56,990	32.5
ROME CABLE CORPORATION	224	0.1	603	0.3	535	0.3	537	0.3
TOTAL for ALCOA and ROME	68,074	43.3	56,764	30.1	59,499	32.8	57,527	32.8
OTHER FIRMS:								
Anaconda Wire and Cable Company	13,899	8.8	23,660	12.6	27,515	15.1	27,156	15.5
Kaiser Aluminum and Chemical Corp. 2/	32,647	20.8	37,498	19.9	32,370	17.8	38,462	22.0
Bristol Plant of U. S. Rubber Co. 3/	83	0.1	91	0.0				
Olin Mathieson Chemical Corp.					10,469	5.8	7,355	4.2
Southern Electrical Corp. 4/	9,355	5.9	16,401	8.7				
Reynolds Metals Company	15,184	9.7	18,582	9.9	19,035	10.5	21,168	12.1
General Cable Corp.	2,551	1.6	7,734	4.1	13,215	7.3	8,777	5.0
Essex Wire Corp. 5/	4,082	2.6	5,162	2.7	5,204	2.9	7,143	4.1
Southwire Co.	5,075	3.2	11,735	6.2	7,211	4.0	3,984	2.3
Nehring Electrical Works	4,526	2.9	5,913	3.1	4,792	2.6	1,083	0.6
Other Shipments Reported to BDSA 6/	1,761	1.1	4,742	2.5	2,391	1.3	2,502	1.4

SHIPMENTS OF ACSR AND ALUMINUM CABLE, BARE, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958		1959	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
...TS REPORTED TO BDSA 1/	157,237	100.0	188,282	100.0	181,701	100.0	175,157	100.0	197,065	100.0
...ERICA	67,850	43.2	56,161	29.8	58,964	32.5	56,990	32.5	61,934	31.4
	224	0.1	603	0.3	535	0.3	537	0.3	1,342	0.7
...E	68,074	43.3	56,764	30.1	59,499	32.8	57,527	32.8	63,276	32.1
... Cable Company	13,899	8.8	23,660	12.6	27,515	15.1	27,156	15.5	31,911	16.2
...nd Chemical Corp. 2/	32,647	20.8	37,498	19.9	32,370	17.8	38,462	22.0	34,442	17.5
...J. S. Rubber Co. 3/	83	0.1	91	0.0						
...emical Corp.					10,469	5.8	7,355	4.2	10,093	5.1
...l Corp. 4/	9,355	5.9	16,401	8.7						
...mpany	15,184	9.7	18,582	9.9	19,035	10.5	21,168	12.1	25,285	12.8
...	2,551	1.6	7,734	4.1	13,215	7.3	8,777	5.0	10,582	5.4
5/	4,082	2.6	5,162	2.7	5,204	2.9	7,143	4.1	4,644	2.4
	5,075	3.2	11,735	6.2	7,211	4.0	3,984	2.3	9,767	5.0
... Works	4,526	2.9	5,913	3.1	4,792	2.6	1,083	0.6	4,428	2.2
...ported to BDSA 6/	1,761	1.1	4,742	2.5	2,391	1.3	2,502	1.4	2,637	1.3

[fol. 5902]

1/ Percentages may not sum to 100 because of rounding of numbers.

2/ Shipments by Kaiser Aluminum were estimated by substracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies. The sources of the total shipments of all integrated companies are U. S. Department of Commerce, BDSA, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950-1957," May 7, 1958, p. 1, for the years 1955-1957, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, for the years 1958 and 1959.

3/ Acquired by Kaiser on February 11, 1957. Bristol plant shipments are included in Kaiser shipments for all of 1957 as well as 1958 and 1959.

4/ Acquired by Olin Mathieson on May 6, 1957. Southern Electrical shipments are listed as shipments by Olin for all of 1957 as well as 1958 and 1959.

5/ Shipments for all years based on information supplied by Essex Wire Corporation to the Department of Justice. Essex based the figures for 1955, 1956, and 1959 on reports to BDSA, but Essex estimated shipments for some months in 1957 and 1958.

6/ Central Cable Corporation is the only other company known to have produced and reported shipments of ACSR and Aluminum Cable, Bare, but it supplied the Department of Justice no information on its shipments.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice; total industry shipments from U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950-1957," May 7,1958 and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961.

[fol. 5903] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 436

SHIPMENTS OF ALUMINUM WIRE AND CABLE, INSULATED OR COVERED, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
TOTAL INDUSTRY SHIPMENTS REPORTED TO BDSA 1/	40,091	100.0	57,588	100.0	50,753	100.0	51,346	100.0
ALUMINUM COMPANY OF AMERICA	4,349	10.8	4,919	8.5	4,778	9.4	5,970	11.6
ROME CABLE CORPORATION	2,782	6.9	3,596	6.2	2,707	5.3	2,411	4.7
TOTAL FOR ALCOA AND ROME	7,131	17.7	8,515	14.7	7,485	14.7	8,381	16.3
OTHER FIRMS:								
Anaconda Wire and Cable Company	7,303	18.2	9,648	16.8	8,964	17.7	8,697	16.9
Kaiser Aluminum Chemical Corp. 2/	10,605	26.5	10,437	18.1	11,295	22.3	13,781	26.8
Bristol Plant of U.S. Rubber Co. 3/	1,520	3.8	1,835	3.2				
Olin Mathieson Chemical Corp.					2,536	5.0	2,729	5.3
Southern Electrical Corp. 4/	2,237	5.6	3,504	6.1				
Reynolds Metals Company	652	1.6	1,422	2.5	1,917	3.8	2,468	4.8
John A. Roebling's Sons 5/							107	0.2
General Cable Corp.	3,309	8.3	3,345	5.8	6,038	11.9	4,879	9.5
Essex Wire Corporation 6/	2,655	6.6	2,461	4.3	2,501	4.9	3,116	6.1
Hendrix Wire and Cable Corp.	221	0.6	[illegible]	0.4	[illegible]	[illegible]	[illegible]	[illegible]

PLAINTIFF'S EXHIBIT 436

SHIPMENTS OF ALUMINUM WIRE AND CABLE, INSULATED OR COVERED, 1955 - 1959

(Thousands of Pounds of Aluminum Content)

	1955		1956		1957		1958		1959	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
MENTS REPORTED TO BDSA 1/	40,091	100.0	57,588	100.0	50,753	100.0	51,346	100.0	61,153	100.0
AMERICA	4,349	10.8	4,919	8.5	4,778	9.4	5,970	11.6	7,461	12.2
ION	2,782	6.9	3,596	6.2	2,707	5.3	2,411	4.7	2,680	4.4
ROME	7,131	17.7	8,515	14.7	7,485	14.7	8,381	16.3	10,141	16.6
and Cable Company	7,303	18.2	9,648	16.8	8,964	17.7	8,697	16.9	11,476	18.8
n Chemical Corp. 2/	10,605	26.5	10,437	18.1	11,295	22.3	13,781	26.8	14,564	23.8
of U.S. Rubber Co. 3/	1,520	3.8	1,835	3.2						
Chemical Corp.					2,536	5.0	2,729	5.3	2,751	4.5
rical Corp. 4/	2,237	5.6	3,504	6.1						
s Company	652	1.6	1,422	2.5	1,917	3.8	2,468	4.8	2,709	4.4
g's Sons 5/							107	0.2	360	0.6
Corp.	3,309	8.3	3,345	5.8	6,038	11.9	4,879	9.5	6,370	10.4
poration 6/	2,655	6.6	2,461	4.3	2,501	4.9	3,116	6.1	2,519	4.1
nd Cable Corp.	221	0.6	252	0.4	309	0.6	356	0.7	538	0.9

	1955		1956		1957		1958	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
TOTAL INDUSTRY SHIPMENTS REPORTED TO BDSA 1/	40,091	100.0	57,588	100.0	50,753	100.0	51,346	100.0
ALUMINUM COMPANY OF AMERICA	4,349	10.8	4,919	8.5	4,778	9.4	5,970	11.6
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Hendrix Wire and Cable Corp.	221	0.6	252	0.4	309	0.6	356	0.7
Okonite Company 7/	588	1.5	1,313	2.3	369	0.7	110	0.2
Southwire Company	911	2.3	4,289	7.4	1,160	2.3	1,289	2.5
Walker Brothers	506	1.3	360	0.6	411	0.8	316	0.6
Western Electric			1,800	3.1	2,500	4.9	200	0.4
Westinghouse Electric Corp. 8/			144	0.3	103	0.2		
Other Shipments Reported to BDSA 9/	2,453	6.1	8,263	14.3	5,165	10.2	4,917	9.6

	1955		1956		1957		1958		1959	
	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total	Shipments	Percent of Total
IIPMENTS REPORTED TO BDSA 1/	40,091	100.0	57,588	100.0	50,753	100.0	51,346	100.0	61,153	100.0
OF AMERICA	4,349	10.8	4,919	8.5	4,778	9.4	5,970	11.6	7,461	12.2
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any 7/	588	1.5	1,313	2.3	369	0.7	110	0.2	361	0.6
mpany	911	2.3	4,289	7.4	1,160	2.3	1,289	2.5	2,368	3.9
ers	506	1.3	360	0.6	411	0.8	316	0.6	175	0.3
tric			1,800	3.1	2,500	4.9	200	0.4	0	0.0
Electric Corp. 8/			144	0.3	103	0.2				
nts Reported to BDSA 9/	2,453	6.1	8,263	14.3	5,165	10.2	4,917	9.6	6,821	11.2

The Business and Defense Services Administration requires reports only for months in which total shipments of aluminum products a firm amounted to 10 thousand or more pounds. Thus the maximum amount that a firm could ship in a year and not be required to port would be under 120 thousand pounds per year of all aluminum products. Only if a firm produced only aluminum wire and cable, sulated or covered, and its shipments were spread evenly over the twelve months could it produce 120 thousand non-reportable pounds any calendar year. In 1955, the year with the lowest industry total, 120 thousand pounds would be less than three-tenths of e per cent of the industry total. Individual company reports to the Department of Justice, however, show that six firms shipped re than 120 thousand pounds in one or more of these years, but did not report their shipments to BDSA. Circle Wire and Gable rporation shipments ranged from less than one-tenth of one per cent in 1955 and 1956 to one per cent of the BDSA total in 1959. llyer Insulated Wire Company reported to the Department of Justice its use of aluminum wire and cable in its production of insulated oducts rather than its actual shipments. Assuming that its shipments corresponded with its production, its total for 1955 and 1956 s more than 120 thousand pounds, but less than one-half of one per cent of the BDSA industry total. Continental Copper and Steel ndustries, Inc., shipped less than four-tenths of one per cent in 1959. General Electric Company shipments ranged from six-tenths f one per cent in 1955 to one and a half per cent in 1959. Narragansett Wire Company shipped three-tenths of one per cent of the BDSA otal in 1958 and four-tenths of one per cent of the BDSA total in 1959. Triangle Conduit and Cable Company shipments ranged from even-tenths of one per cent in 1957 to less than one-tenth of one per cent in 1959. The combined shipments of these companies ranged rom one per cent in 1955 to two and a half per cent in 1959. The addition of these shipments to BDSA total would change no market share y more than six-tenths of one percentage point. Percentages may not sum to 100 because of rounding of numbers.

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9/ Five other firms are known to have reported some shipments of aluminum wire and cable, insulated or covered, to BDSA. Central Cable Corporation supplied the Department of Justice no information on its shipments. The American Steel and Wire Division of the United States Steel Corporation reported to BDSA in 1955, 1956, and 1957, shipments amounting to less than one-half of one per cent of the industry total reported to BDSA. In 1958 and 1959 this company's shipments were less than 10 thousand pounds per month and therefore not reported. The Collyer Insulated Wire Company filed reports with BDSA in 1958 and 1959, but indicated shipments less than 10 thousand pounds per month. The Crescent Insulated Wire and Cable Company filed reports with BDSA, but its shipments averaged less than 10 thousand pounds per month for all years except 1956 for which the company reported to the Department of Justice for the first eight months only. Nehring Electrical Works reported less than one-tenth of one per cent of the industry total in 1958 and 1959.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments.

a firm ... would report would be under 120 thousand pounds per year of all aluminum products. Only if a firm produced only aluminum wire and cable, insulated or covered, and its shipments were spread evenly over the twelve months could it produce 120 thousand non-reportable pounds in any calendar year. In 1955, the year with the lowest industry total, 120 thousand pounds would be less than three-tenths of one per cent of the industry total. Individual company reports to the Department of Justice, however, show that six firms shipped more than 120 thousand pounds in one or more of these years, but did not report their shipments to BDSA. Circle Wire and Cable Corporation shipments ranged from less than one-tenth of one per cent in 1955 and 1956 to one per cent of the BDSA total in 1959. Collyer Insulated Wire Company reported to the Department of Justice its use of aluminum wire and cable in its production of insulated products rather than its actual shipments. Assuming that its shipments corresponded with its production, its total for 1955 and 1956 was more than 120 thousand pounds, but less than one-half of one per cent of the BDSA industry total. Continental Copper and Steel Industries, Inc., shipped less than four-tenths of one per cent in 1959. General Electric Company shipments ranged from six-tenths of one per cent in 1955 to one and a half per cent in 1959. Narragansett Wire Company shipped three-tenths of one per cent of the BDSA total in 1958 and four-tenths of one per cent of the BDSA total in 1959. Triangle Conduit and Cable Company shipments ranged from seven-tenths of one per cent in 1957 to less than one-tenth of one per cent in 1959. The combined shipments of these companies ranged from one per cent in 1955 to two and a half per cent in 1959. The addition of these shipments to BDSA total would change no market share by more than six-tenths of one percentage point. Percentages may not sum to 100 because of rounding of numbers.

2/ Shipments by Kaiser Aluminum were estimated by subtracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies. The sources of the total shipments of all integrated companies are U.S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954-1957", November 8, 1961, for the years 1955 through 1957; from "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers for the years 1958-1960", November 17, 1961, for the years 1958 and 1959.

3/ Acquired by Kaiser on February 11, 1957. Bristol plant shipments are included in Kaiser shipments for all of 1957 as well as 1958 and 1959.

4/ Acquired by Olin Mathieson on May 6, 1957. Southern Electrical shipments are listed as shipments by Olin for all of 1957 as well as 1958 and 1959.

5/ Division of Colorado Fuel and Iron Corp. Most of the aluminum wire and cable machinery of Roebling was purchased by Reynolds in March 1961.

6/ Shipments of all years based on information supplied by Essex to the Department of Justice. Essex based the figures for 1955, 1956, and 1959 on reports to BDSA, but Essex estimated shipments for some months in 1957 and 1958.

7/ The Okonite Company was acquired by Kennecott Copper Corporation on November 24, 1958.

8/ Westinghouse shipped between 10 and 50 thousand pounds in 1958, and between 50 and 100 pounds in 1955 and 1959.

9/ Five other firms are known to have reported some shipments of aluminum wire and cable, insulated or covered, to BDSA. Central Cable Corporation supplied the Department of Justice no information on its shipments. The American Steel and Wire Division of the United States Steel Corporation reported to BDSA in 1955, 1956, and 1957, shipments amounting to less than one-half of one per cent of the industry total reported to BDSA. In 1958 and 1959 this company's shipments were less than 10 thousand pounds per month and therefore not reported. The Collyer Insulated Wire Company filed reports with BDSA in 1958 and 1959, but indicated shipments less than 10 thousand pounds per month. The Crescent Insulated Wire and Cable Company filed reports with BDSA, but its shipments averaged less than 10 thousand pounds per month for all years except 1956 for which the company reported to the Department of Justice for the first eight months only. Nehring Electrical Works reported less than one-tenth of one per cent of the industry total in 1958 and 1959.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice; total industry shipments from U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954-1957", November 8, 1961, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers 1958-1960", November 17, 1961.

[fol. 5905] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 438

CONCENTRATION OF SHIPMENTS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1/
ACCOUNTED FOR BY INTEGRATED PRODUCERS, 1955-1959

(Thousands of Pounds of Aluminum Content)

	Shipments	Shipments	Percent of Industry Total
1955			
Industry Total as Reported to BDSA		197,328	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		66,041	33.5
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		131,287	66.5
Aluminum Company of America	72,199		
Kaiser Aluminum and Chemical Corporation 2/	43,252		
Reynolds Metals Company	15,836		
1956			
Industry Total as Reported to BDSA		245,870	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		83,543	34.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		162,327	65.9
Aluminum Company of America	61,080		
Kaiser Aluminum and Chemical Corporation 2/	47,935		
Reynolds Metals Company	20,004		
Anaconda Wire & Cable Company 3/	33,308		
1957			
Industry Total as Reported to BDSA		232,454	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		67,616	29.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		164,838	70.9
Aluminum Company of America	63,742		
Kaiser Aluminum and Chemical Corporation 2 4/	43,665		

Kaiser Aluminum and Chemical Corporation 2/	12,199		
	43,252		
Reynolds Metals Company	15,836		
1956			
Industry Total as Reported to BDSA		245,870	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		83,543	34.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		162,327	65.9
Aluminum Company of America	61,080		
Kaiser Aluminum and Chemical Corporation 2/	47,935		
Reynolds Metals Company	20,004		
Anaconda Wire & Cable Company 3/	33,308		
1957			
Industry Total as Reported to BDSA		232,454	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		67,616	29.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		164,838	70.9
Aluminum Company of America	63,742		
Kaiser Aluminum and Chemical Corporation 2,4/	43,665		
Reynolds Metals Company	20,952		
Anaconda Wire & Cable Company	36,479		
1958			
Industry Total as Reported to BDSA		226,503	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		41,727	18.4
TOTAL SHIPMENTS OF INTEGRATED COMPANIES 6/		184,776	81.6
Aluminum Company of America	62,960		
Kaiser Aluminum and Chemical Corporation 2/	52,243		
Reynolds Metals Company	23,636		
Anaconda Wire & Cable Company	35,853		
Olin Mathieson Chemical Corporation 5/	10,084		
1959			
Industry Total as Reported to BDSA		258,218	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		51,570	19.9
TOTAL SHIPMENTS OF INTEGRATED COMPANIES 6/		206,648	80.1
Aluminum Company of America 7/	73,417		
Kaiser Aluminum and Chemical Corporation 2/	49,006		
Reynolds Metals Company	27,994		
Anaconda Wire & Cable Company	43,387		
Olin Mathieson Chemical Corporation	12,844		

[fol. 5906]

1/ Shipments of aluminum conductor wire and cable are the sum of the shipments of aluminum wire, insulated or covered, and ACSR and aluminum cable, bare.

2/ Shipments by Kaiser were estimated by subtracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies included in U. S. Department of Commerce, BDSA, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950 - 1957," May 7, 1958, p. 1 and "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954 - 1957," November 8, 1961, for the years 1955 through 1957, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958 - 1960," November 17, 1961, for the years 1958 and 1959.

3/ The Anaconda Company became a producer of primary aluminum in late 1955.

4/ Bristol plant shipments are included in the Kaiser figure for all of 1957 and thereafter. This plant was acquired by Kaiser on February 11, 1957.

5/ Olin Mathieson became a producer of primary aluminum in 1958, through a jointly owned subsidiary, Ormet Corporation. Southern Electrical Corporation was acquired by Olin Mathieson on May 6, 1957, and its shipments were reported to BDSA as shipments of Olin after that date, and are included as integrated for all of 1958.

6/ If General Cable Corporation were treated as an integrated company after the entry of Ormet Corporation, because of the intercorporate stock relationship among General Cable, American Smelting and Refining Company, Revere Copper, and Ormet Corporation, then the integrated companies' share would be 87.6 percent in 1958 and 86.7 percent in 1959.

7/ Rome's shipments are treated as integrated for the whole year 1959.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice; total industry shipments from U. S. Department of Commerce, Business and Defense Service Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950 - 1957," May 7, 1958, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954 - 1957," November 8, 1961, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958 - 1960," November 17, 1961.

[fol. 5907] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 439

CONCENTRATION OF SHIPMENTS OF ACSR AND ALUMINUM CABLE, BARE, ACCOUNTED FOR BY INTEGRATED PRODUCERS, 1955-1959

(Thousands of Pounds of Aluminum Content)

	Shipments	Shipments	Percent of Industry Total
1955			
Industry Total as Reported to BDSA		157,237	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		41,556	26.3
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		115,681	73.7
Aluminum Company of America	67,850		
Kaiser Aluminum and Chemical Corporation 1/	32,647		
Reynolds Metals Company	15,184		
1956			
Industry Total as Reported to BDSA		188,282	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		52,381	27.8
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		135,901	72.2
Aluminum Company of America	56,161		
Kaiser Aluminum and Chemical Corporation 1/	37,498		
Reynolds Metals Company	18,582		
Anaconda Wire & Cable Company 2/	23,660		
1957			
Industry Total as Reported to BDSA		181,701	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		43,817	24.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		137,884	75.9
Aluminum Company of America	58,964		
Kaiser Aluminum and Chemical Corporation 1,3/	32,370		

1956			
Industry Total as Reported to BDSA		188,282	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		52,381	27.8
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		135,901	72.2
Aluminum Company of America	56,161		
Kaiser Aluminum and Chemical Corporation 1/	37,498		
Reynolds Metals Company	18,582		
Anaconda Wire & Cable Company 2/	23,660		
1957			
Industry Total as Reported to BDSA		181,701	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		43,817	24.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		137,884	75.9
Aluminum Company of America	58,964		
Kaiser Aluminum and Chemical Corporation 1,3/	32,370		
Reynolds Metals Company	19,035		
Anaconda Wire & Cable Company	27,515		
1958			
Industry Total as Reported to BDSA		175,157	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		24,026	13.7
TOTAL SHIPMENTS OF INTEGRATED COMPANIES 5/		151,131	86.3
Aluminum Company of America	56,990		
Kaiser Aluminum and Chemical Corporation 1/	38,462		
Reynolds Metals Company	21,168		
Anaconda Wire & Cable Company	27,156		
Olin Mathieson Chemical Corporation 4/	7,355		
1959			
Industry Total as Reported to BDSA		197,065	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		32,058	16.3
TOTAL SHIPMENTS OF INTEGRATED COMPANIES 5/		165,007	83.7
Aluminum Company of America 6/	63,276		
Kaiser Aluminum and Chemical Corporation 1/	34,442		
Reynolds Metals Company	25,285		
Anaconda Wire & Cable Company	31,911		
Olin Mathieson Chemical Corporation	10,093		

[fol. 5908]

1/ Shipments by Kaiser Aluminum were estimated by subtracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies included in U. S. Department of Commerce, BDSA, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-integrated Producers, 1950-1957," May 7, 1958, p. 1, for the years 1955-1957, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, for the years 1958 and 1959.

2/ The Anaconda Company became a producer of primary aluminum in late 1955.

3/ Bristol plant shipments are included in the Kaiser figure for all of 1957 and thereafter. This plant was acquired by Kaiser on February 11, 1957.

4/ Olin Mathieson became a producer of primary aluminum in 1958, through a jointly owned subsidiary, Ormet Corporation. Southern Electrical Corporation was acquired by Olin Mathieson on May 6, 1957, and its shipments were reported to BDSA as shipments of Olin after that date and are included as integrated for all of 1958.

5/ If General Cable Corporation were treated as an integrated company after the entry of Ormet Corporation, because of the intercorporate stock relationship among General Cable, American Smelting and Refining Company, Revere Copper, and Ormet Corporation, then the integrated companies' share would be 91.3 percent in 1958 and 89.1 percent in 1959.

6/ Rome's shipments are treated as integrated for the whole year 1959.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice, total industry shipments from U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950-1957," May 7, 1958, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-integrated Producers, 1958-1960," November 17, 1961, adjusted as indicated in footnotes.

[fol. 5909] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 440

(Thousands of Pounds of Aluminum Content)

	Shipments	Shipments	Percent of Industry Total
1955			
Industry Total as Reported to BDSA		40,091	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		24,485	61.0
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		15,606	39.0
Aluminum Company of America	4,349		
Kaiser Aluminum and Chemical Corporation 1/	10,605		
Reynolds Metals Company	652		
1956			
Industry Total as Reported to BDSA		57,588	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		31,162	54.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		26,426	45.9
Aluminum Company of America	4,919		
Kaiser Aluminum and Chemical Corporation 1/	10,437		
Reynolds Metals Company	1,422		
Anaconda Wire & Cable Company 2/	9,648		
1957			
Industry Total as Reported to BDSA		50,753	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		23,799	46.8
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		26,954	53.2

Reynolds Metals Company	652		
1956			
Industry Total as Reported to BDSA		57,588	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		31,162	54.1
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		26,426	45.9
Aluminum Company of America	4,919		
Kaiser Aluminum and Chemical Corporation 1/	10,437		
Reynolds Metals Company	1,422		
Anaconda Wire & Cable Company 2/	9,648		
1957			
Industry Total as Reported to BDSA		50,753	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		23,799	46.8
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		26,954	53.2
Aluminum Company of America	4,778		
Kaiser Aluminum and Chemical Corporation 1,3/	11,295		
Reynolds Metals Company	1,917		
Anaconda Wire & Cable Company	8,964		
1958			
Industry Total as Reported to BDSA		51,346	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		17,701	34.6
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		33,645	65.4
Aluminum Company of America	5,970		
Kaiser Aluminum and Chemical Corporation 1/	13,781		
Reynolds Metals Company	2,468		
Anaconda Wire & Cable Company	8,697		
Olin Mathieson Chemical Corporation 4/	2,729		
1959			
Industry Total as Reported to BDSA		61,153	100.0
TOTAL SHIPMENTS OF NONINTEGRATED COMPANIES		19,512	31.9
TOTAL SHIPMENTS OF INTEGRATED COMPANIES		41,641	68.1
Aluminum Company of America 6/	10,141		
Kaiser Aluminum and Chemical Corporation 1/	14,564		
Reynolds Metals Company	2,709		
Anaconda Wire & Cable Company	11,476		
Olin Mathieson Chemical Corporation	2,751		

1/ Shipments by Kaiser Aluminum were estimated by subtracting the shipments reported to the Department of Justice by the other integrated companies from the total shipments of all integrated companies included in U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954-1957," November 8, 1961, for the years 1955 through 1957; from "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, for the years 1958 and 1959.

2/ The Anaconda Company became a producer of primary aluminum in late 1955.

3/ Bristol plant shipments are included in the Kaiser figure for all of 1957 and thereafter. This plant was acquired by Kaiser on February 11, 1957.

4/ Olin Mathieson became a producer of primary aluminum in 1958, through a jointly owned subsidiary, Ormet Corporation. Southern Electrical Corporation was acquired by Olin Mathieson on May 6, 1957, and its shipments were reported to BDSA as shipments of Olin after that date, and are included as integrated for all of 1958.

5/ If General Cable Corporation were treated as an integrated company after the entry of Ormet Corporation, because of the intercorporate stock relationship among General Cable, American Smelting and Refining Company, Revere Copper, and Ormet Corporation, then the integrated companies' share would be 65.4 percent in 1958 and 68.1 percent in 1959.

6/ Rome's shipments are treated as integrated for the whole year 1959.

Sources: Alcoa and Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; other company shipments, except as indicated in footnotes, from letters from individual companies to the Department of Justice, total industry shipments from U. S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Wire by Integrated and Nonintegrated Producers 1954-1957," November 8, 1961, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, adjusted as indicated in footnotes.

[fol. 5911] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 441

POSITION OF ROME AMONG NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1955-1958

(Thousands of pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms
I. ALUMINUM CONDUCTOR WIRE AND CABLE								
Nonintegrated Firms 1/	66,041	100.0	83,543	100.0	67,616	100.0	41,727	100.0
ROME CABLE CORPORATION	3,006	4.6	4,199	5.0	3,242	4.8	2,948	7.1
II. ACSR AND ALUMINUM CABLE, BARE								
Nonintegrated Firms 1/	41,556	100.0	52,381	100.0	43,817	100.0	24,026	100.0
ROME CABLE CORPORATION	224	0.5	603	1.2	535	1.2	537	2.2
III. ALUMINUM WIRE AND CABLE, INSULATED OR COVERED								
Nonintegrated Firms 1/	24,485	100.0	31,162	100.0	23,799	100.0	17,701	100.0
ROME CABLE CORPORATION	2,782	11.4	3,596	11.5	2,707	11.4	2,411	13.6

1/ Totals of Nonintegrated Firms as reported by Business and Defense Services Administration revised to exclude Anaconda Wire and Cable Company in 1956 and 1957, and Bristol for all of 1957.

SOURCES: Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1;

[fol. 5911] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 441

POSITION OF ROME AMONG NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1955-1958

(Thousands of pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms
I. ALUMINUM CONDUCTOR WIRE AND CABLE								
Nonintegrated Firms 1/	66,041	100.0	83,543	100.0	67,616	100.0	41,727	100.0
ROME CABLE CORPORATION	3,006	4.6	4,199	5.0	3,242	4.8	2,948	7.1
II. ACSR AND ALUMINUM CABLE, BARE								
Nonintegrated Firms 1/	41,556	100.0	52,381	100.0	43,817	100.0	24,026	100.0
ROME CABLE CORPORATION	224	0.5	603	1.2	535	1.2	537	2.2
III. ALUMINUM WIRE AND CABLE, INSULATED OR COVERED								
Nonintegrated Firms 1/	24,485	100.0	31,162	100.0	23,799	100.0	17,701	100.0
ROME CABLE CORPORATION	2,782	11.4	3,596	11.5	2,707	11.4	2,411	13.6

1/ Totals of Nonintegrated Firms as reported by Business and Defense Services Administration revised to exclude Anaconda Wire and Cable Co [illegible]

POSITION OF ROME AMONG NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1955-1958

(Thousands of pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms
I. ALUMINUM CONDUCTOR WIRE AND CABLE								
Nonintegrated Firms 1/	66,041	100.0	83,543	100.0	67,616	100.0	41,727	100.0
ROME CABLE CORPORATION	3,006	4.6	4,199	5.0	3,242	4.8	2,948	7.1
II. ACSR AND ALUMINUM CABLE, BARE								
Nonintegrated Firms 1/	41,556	100.0	52,381	100.0	43,817	100.0	24,026	100.0
ROME CABLE CORPORATION	224	0.5	603	1.2	535	1.2	537	2.2
III. ALUMINUM WIRE AND CABLE, INSULATED OR COVERED								
Nonintegrated Firms 1/	24,485	100.0	31,162	100.0	23,799	100.0	17,701	100.0
ROME CABLE CORPORATION	2,782	11.4	3,596	11.5	2,707	11.4	2,411	13.6

1/ Totals of Nonintegrated Firms as reported by Business and Defense Services Administration revised to exclude Anaconda Wire and Cable Company in 1956 and 1957, and Bristol for all of 1957.

SOURCES: Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; total shipments of nonintegrated firms from U.S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950-1957," May 7, 1958, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, and individual company letters to Department of Justice.

POSITION OF ROME AMONG NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE AND CABLE 1955-1958

(Thousands of pounds of Aluminum Content)

	1955		1956		1957		1958	
	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms	Shipments	Percent of Shipments of Nonintegrated Firms
I. ALUMINUM CONDUCTOR WIRE AND CABLE								
ated 1/	66,041	100.0	83,543	100.0	67,616	100.0	41,727	100.0
E ATION	3,006	4.6	4,199	5.0	3,242	4.8	2,948	7.1
II. ACSR AND ALUMINUM CABLE, BARE								
ated 1/	41,556	100.0	52,381	100.0	43,817	100.0	24,026	100.0
E TION	224	0.5	603	1.2	535	1.2	537	2.2
III. ALUMINUM WIRE AND CABLE, INSULATED OR COVERED								
ated 1/	24,485	100.0	31,162	100.0	23,799	100.0	17,701	100.0
E TION	2,782	11.4	3,596	11.5	2,707	11.4	2,411	13.6

s of Nonintegrated Firms as reported by Business and Defense Services Administration revised to exclude nda Wire and Cable Company in 1956 and 1957, and Bristol for all of 1957.

Rome shipments from Defendants' Answers to Plaintiff's Interrogatories, Answer to Interrogatory 1; total shipments of nonintegrated firms from U.S. Department of Commerce, Business and Defense Services Administration, Aluminum and Magnesium Division, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1950-1957," May 7, 1958, and "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers, 1958-1960," November 17, 1961, and individual company letters to Department of Justice.

[fol. 5912] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 442

Companies Listed as Producing Aluminum Conductor Wire and Cable[1] in the U. S. Department of Commerce BDSA Directory of Aluminum Suppliers, Dated April 1, 1961, but not listed in the Directory for June 30, 1955

Olin Mathieson Chemical Corporation[2]

Hatfield Wire and Cable Corporation Division of Continental Copper and Steel Industries

Circle Wire and Cable Corporation, Subsidiary of Cerro Corporation[3]

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[1] The Directory of Aluminum Suppliers is broken down into a number of categories. This tabulation lists all companies that were listed in either the "ACSR and Aluminum Cable, bare" category or the "Wire and Cable, insulated or covered" category in the 1961 directory but not listed in either category in the 1955 directory.

[2] The Olin Mathieson Chemical Corporation displaced Southern Electrical Corporation which company was acquired by Olin Mathieson on May 6, 1957.

[3] While Circle Wire and Cable Corporation is not listed as a producer of these products in the directory for June 30, 1955, but Circle indicated in a letter to the Department of Justice dated August 22, 1961, that it did manufacture aluminum conductor wire in 1955.

[fol. 5913] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 443

Shipments of Aluminum Weatherproof and Service Drop Wire and Cable Compared with Total Shipments of Aluminum Wire and Cable, Insulated or Covered, by Six Companies,[1] 1959.

Company	Total Insulated or Covered[2]	Weatherproof and Service Drop[2]	Weatherproof and Service Drop as Percent of Total Insulated or Covered
Aluminum Company of America....	7,550	7,550	100.0
Rome Cable Corporation...........	2,677	2,438	91.1
Anaconda Wire and Cable Company.	11,476	11,017	96.0
General Cable Corporation..........	46,704[3,4]	45,902[3]	98.3
Kaiser Aluminum & Chemical Corp..	15,356	11,092	72.2
Southwire Company..............	2,388	2,384	99.8

[1] These six companies in 1959 shipped 73.5 percent of all shipments of aluminum wire and cable, insulated or covered, reported to BDSA. These six are the only companies for which the Department of Justice has data on weatherproof and service drop shipments that are comparable with data on total insulated or covered shipments.

[2] Thousands of pounds of aluminum content except where indicated otherwise.

[3] Measured in feet.

[4] The letter from General Cable says sales of some other unspecified aluminum insulated wire and cable amounted to "a small fraction of one percent." This figure is based on the assumption that the unspecified sales were exactly one percent.

Sources: Alcoa and Rome figures from Defendants' Answers to Plaintiff Interrogatories numbers 5 and 4, respectively; other figures from individual company letters to the Department of Justice.

PLAINTIFF'S EXHIBIT 444

SALES BY DOMESTIC PRIMARY ALUMINUM PRODUCERS OF E. C. ALUMINUM PIG AND INGOT AND E. C. ALUMINUM ROD AND BAR TO NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE & CABLE, AND TO OTHER FIRMS

1956 - 1959

(Thousands of Pounds)

	1956		1957		1958		1959
	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable
E. C. ALUMINUM PIG & INGOT SOLD BY:							
ALUMINUM COMPANY OF AMERICA	18,660	-	13,926	71	11,565	5,012	3,833
Anaconda Wire & Cable Co.	3,137	-	3,241	-	2,131	-	1,878
Harvey Aluminum							1,935
Kaiser Aluminum and Chemical Corp.	3,150	-	2,938	5	1,926	23	728
Reynolds Metals Company	3,962	-	2,381	-	454	-	1,636
Olin Mathieson Chemical Co.						1,383	7
Total	28,909	-	22,486	76	16,076	6,418	10,017
E. C. ALUMINUM BAR & ROD SOLD BY:							
ALUMINUM COMPANY OF AMERICA	16,262	25	12,028	-	6,950	-	13,654
Anaconda Wire & Cable Co.	300	-	30	-	-	-	-
Harvey Aluminum							-
Kaiser Aluminum and Chemical Corp.	22,279	3,328	8,081	3,036	8,896	522	8,220
Reynolds Metals Company	1,849	-	1,169	-	1,133	-	950
Olin Mathieson Chemical Corp.						273	
Total	40,690	3,353	21,308	3,036	16,979	795	22,824
TOTAL OF E. C. ALUMINUM PIG AND INGOT AND BAR AND ROD SOLD BY:							
ALUMINUM COMPANY OF AMERICA	34,922	25	25,954	71	18,515	5,012	17,487
Anaconda Wire & Cable Co.	3,437	-	3,271	-	2,131	-	1,878
Harvey Aluminum							1,935
Kaiser Aluminum and Chemical Corp.	25,429	3,328	11,019	3,041	10,822	545	8,948
Reynolds Metals Co.	5,811		3,550		1,587		2,586
Olin Mathieson Chemical Corp.						1,656	7
Total	69,599	3,353	43,794	3,112	33,055	7,213	32,841

Sources: Alcoa Sales from Defendants' Answers to Plaintiff's Interrogatories, Numbers 20 and 64; other companies from letters from individual companies to the Department of Justice.

PLAINTIFF'S EXHIBIT 444

SALES BY DOMESTIC PRIMARY ALUMINUM PRODUCERS OF E. C. ALUMINUM PIG AND INGOT AND E. C. ALUMINUM ROD AND BAR TO NONINTEGRATED PRODUCERS OF ALUMINUM CONDUCTOR WIRE & CABLE, AND TO OTHER FIRMS
1956 - 1959
(Thousands of Pounds)

	1956		1957		1958		1959	
	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable	To Other Firms	To Nonintegrated Producers of conductor wire & cable	To Other Firms
SOLD BY:								
ERICA	18,660	-	13,926	71	11,565	5,012	3,833	1,898
Co.	3,137	-	3,241	-	2,131	-	1,878	-
emical Corp.	3,150	-	2,938	5	1,926	23	1,935	434
/	3,962	-	2,381	-	454	-	728	103
Co.							1,636	-
						1,383	7	1,579
	28,909	-	22,486	76	16,076	6,418	10,017	4,014
D BY:								
RICA	16,262	25	12,028	-	6,950	-	13,654	-
o.	300	-	30	-	-	-	-	-
							-	-
mical Corp.	22,279	3,328	8,081	3,036	8,896	522	8,220	923
	1,849	-	1,169	-	1,133	-	950	-
Corp.						273		68
	40,690	3,353	21,308	3,036	16,979	795	22,824	991
AND INGOT								
RICA	34,922	25	25,954	71	18,515	5,012	17,487	1,898
o.	3,437	-	3,271	-	2,131	-	1,878	-
							1,935	434
mical Corp.	25,429	3,328	11,019	3,041	10,822	545	8,948	1,026
	5,811		3,550		1,587		2,586	-
Corp.						1,656	7	1,647
	69,599	3,353	43,794	3,112	33,055	7,213	32,841	5,005

rom Defendants' Answers to Plaintiff's Interrogatories, Numbers 20 and 64;
es from letters from individual companies to the Department of Justice.

[fol. 5915] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 450

Value of Shipments of Conductor Wire and Cable, 1958
(Thousands of Dollars)

	1958 Shipments & Interplant Transfers	1958 Percent of Industry Total
Industry Total	1,553,955	100.0
Aluminum Company of America	28,521	1.8
Rome Cable Corporation	22,001	1.4
Rea Magnet Wire Co., Inc.	17,651	1.1
Total of Alcoa, Rome & Rea	68,173	4.3

Sources: Industry total from Bureau of the Census, "1958 Census of Manufactures," MC58(2)–33D; Alcoa figures from Defendant's Answers to Questions 4 and 5 in Plaintiff's Letter of August 19, 1959; Rome figures from Defendant's Answers to Questions 8 and 9 in Plaintiff's Letter of August 18, 1959; Rea figures from Defendants' Answer to Interrogatory 34.

[fol. 5916] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 451

Value of Shipments of Wire and Cable, Insulated and Covered, 1958
(Thousands of Dollars)

	1958 Shipments & Interplant Transfers	1958 Percent of Industry Total
Industry Total	1,321,675	100.0
Aluminum Company of America	4,501	0.3
Rome Cable Corporation	17,422	1.3
Rea Magnet Wire Co., Inc.	17,651	1.3
Total of Alcoa, Rome & Rea	39,574	2.9

Sources: Industry total from Bureau of the Census, "1958 Census of Manufactures," MC58(2)–33D; Alcoa figures from Defendant's Answers to Questions 4 and 5 in Plaintiff's Letter of August 19, 1959; Rome figures from Defendant's Answers to Questions 8 and 9 in Plaintiff's Letter of August 18, 1959; Rea figures from Defendants' Answer to Interrogatory 34.

[fol. 5917] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 452

Value of Shipments of Conductor Wire and Cable, Bare, 1958
(Thousands of Dollars)

	1958 Shipments & Interplant Transfers	1958 Percent of Industry Total
Industry Total	232,280	100.0
Aluminum Company of America	24,020	10.3
Rome Cable Corporation	4,579	2.0
Alcoa and Rome Consolidated	28,599	12.3

Sources: Industry total from Bureau of the Census, "1958 Census of Manufactures," MC58(2)-33D; Alcoa figures from Defendant's Answers to Questions 4 and 5 in Plaintiff's Letter of August 19, 1959; Rome figures from Defendant's Answers to Questions 8 and 9 in Plaintiff's Letter of August 18, 1959.

[fol. 5918] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 454

Value of Shipments of Service Drop Cable, 1958
(Thousands of Dollars)

	1958 Shipments & Interplant Transfers	1958 Percent of Total
Industry Total	$ 28,053	100.0
Aluminum Company of America	3,033	10.8
Rome Cable Corporation	1,424	5.1
Alcoa and Rome Consolidated	4,457	15.9

Sources: Industry total from Bureau of the Census, "1958 Census of Manufactures," MC58(2)-33D, Product Codes 3357944 and 3357945; Alcoa figures from Defendant's Answers to Questions 4 and 5 in Plaintiff's Letter of August 19, 1959; Rome figures from Defendant's Answer to Questions 8 and 9 in Plaintiff's Letter August 18, 1959.

[fol. 5919] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 455

Value of Shipments of Conduit in the United States, 1960
(Thousands of Dollars)

	Shipments & Interplant Transfers	Percent of Industry Total
Industry total[1]	$ 125,707	100.0
Aluminum Company of America[2]	4,285	3.4
Rome Cable Division	4,354	3.5
Alcoa plus Rome	8,639	6.9

[1] The industry total is the sum of Census categories: rigid conduit (standard weight), including couplings, nipples, bends, and elbows: steel (Product Code 3644221) and other (Product Code 3644222), and electrical metallic tubing (thin wall conduit) including couplings, nipples, bends, and elbows: steel (Product Code 3644223) and other (Product Code 3644224), reported on Census Form MA-36K.

[2] Exclusive of sales of fittings.

Sources: Industry total from: U.S. Department of Commerce, Bureau of the Census, "Current Industrial Reports," M36K(60)-1, "Wiring Devices and Supplies, 1960"; Alcoa's figures from Defendants' Answers to Interrogatory 53; Rome's figures from Defendants' Objections to Plaintiff's Proposed Statistical Summaries and Schedules, Compilations and Tabulations, dated January 26, 1962.

Revision from Bureau of the Census letter dated February 1, 1962.

[fol. 5920] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 458

Value of Shipments of Aluminum Conduit, 1960
(Thousands of Dollars)

	Shipments & Interplant Transfers	Percent of Industry Total
Industry Total[1]	16,155	100.0
Alcoa (exclusive of Rome agency sales)[2]	1,938	12.0
Rome (sales as agent of Alcoa)[2]	2,347	14.5
Alcoa (inclusive of Rome agency sales)[2]	4,285	26.5

[1] The industry total is the sum of Census categories: rigid conduit (standard weight), including couplings, nipples, bends, and elbows: other than steel (Product Code 3644222) and electrical metallic tubing (thin wall conduit), including couplings, nipples, bends, and elbows: other than steel (Product Code 3644224), reported on Census Form MA-36K.

[2] Exclusive of fittings.

Sources: Industry total from: U. S. Department of Commerce, Bureau of the Census, "Current Industrial Reports," M36K(60)-1, "Wiring Devices and Supplies, 1960"; Alcoa's figures from Defendants' Answers to Interrogatory 53; Rome's figures from Defendants' Answers to Interrogatory 54.

[fol. 5921] IN UNITED STATES DISTRICT COURT

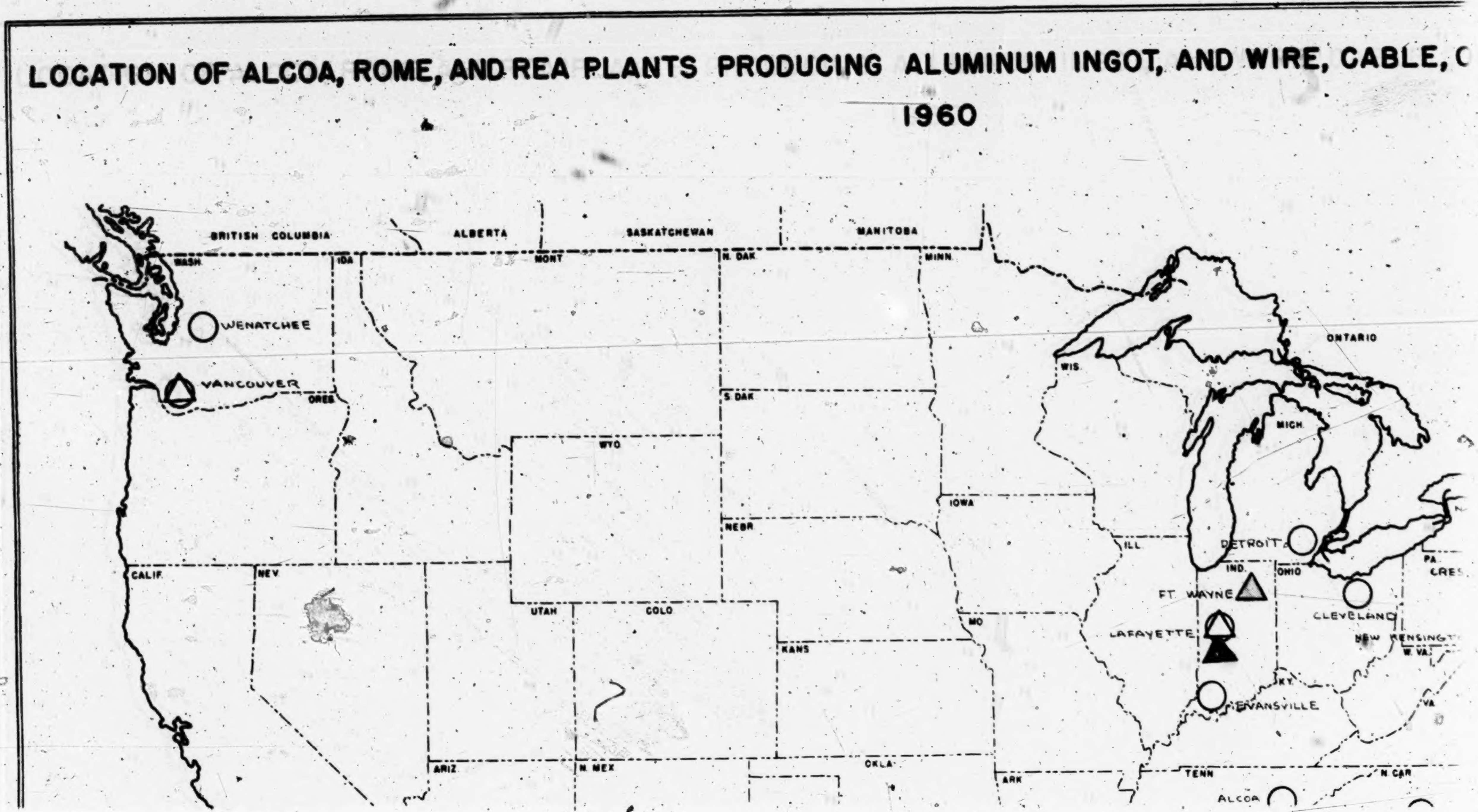
PLAINTIFF'S EXHIBIT 465.

Aluminum Ingot Capacity Existing or Under Construction at the End of 1960
(Short tons)

Company	Capacity	Percent of U. S. Total
United States Total	2,655,750	100.0
Aluminum Company of America	1,025,250	38.6
Reynolds Metals Company	701,000	26.4
Kaiser Aluminum & Chemical Corp.	609,500	23.0
Ormet, Inc.	180,000	6.8
Harvey Aluminum	75,000	2.8
Anaconda Aluminum Company	65,000	2.4

Source: 1960 Minerals Yearbook, Volume 1, Metals and Minerals (Except Fuels), Bureau of Mines, Department of the Interior, Page 168.

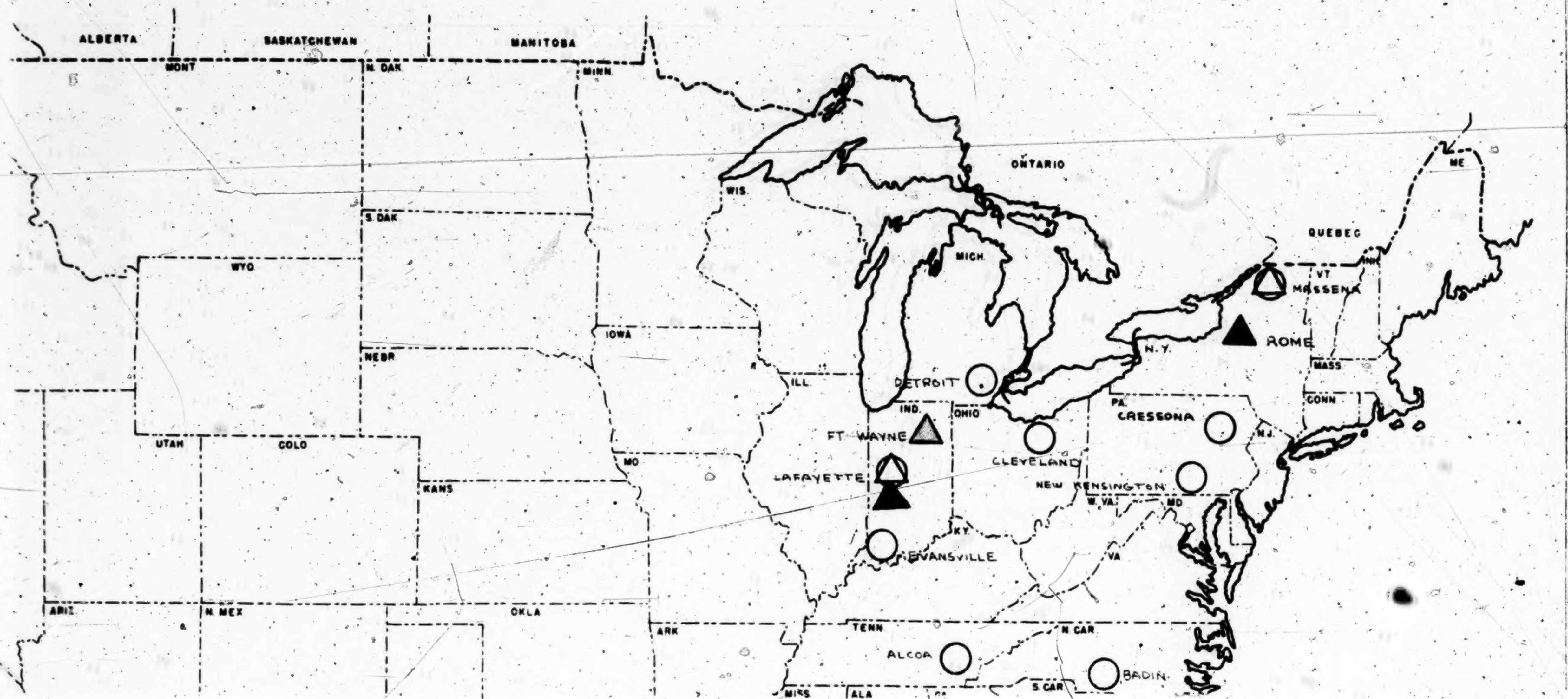
Plaintiff's Exhibit 466

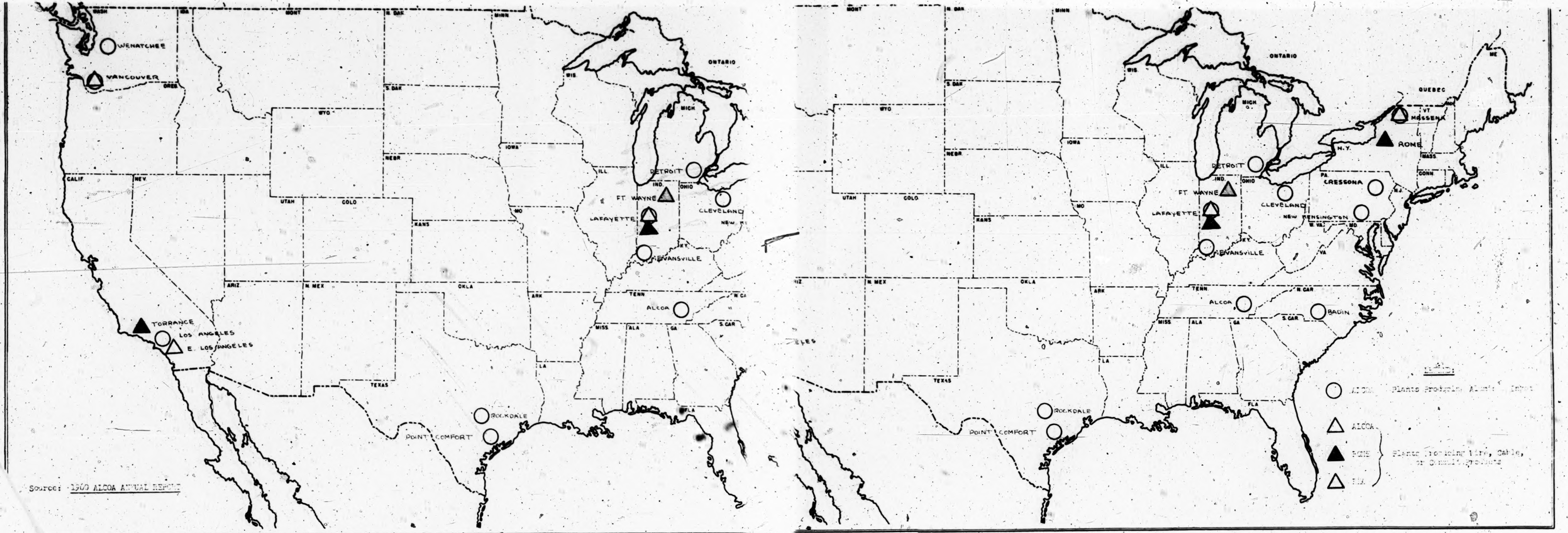


PLAINTIFF'S EXHIBIT 466

ME, AND REA PLANTS PRODUCING ALUMINUM INGOT, AND WIRE, CABLE, OR CONDUIT PRODUCTS

1960





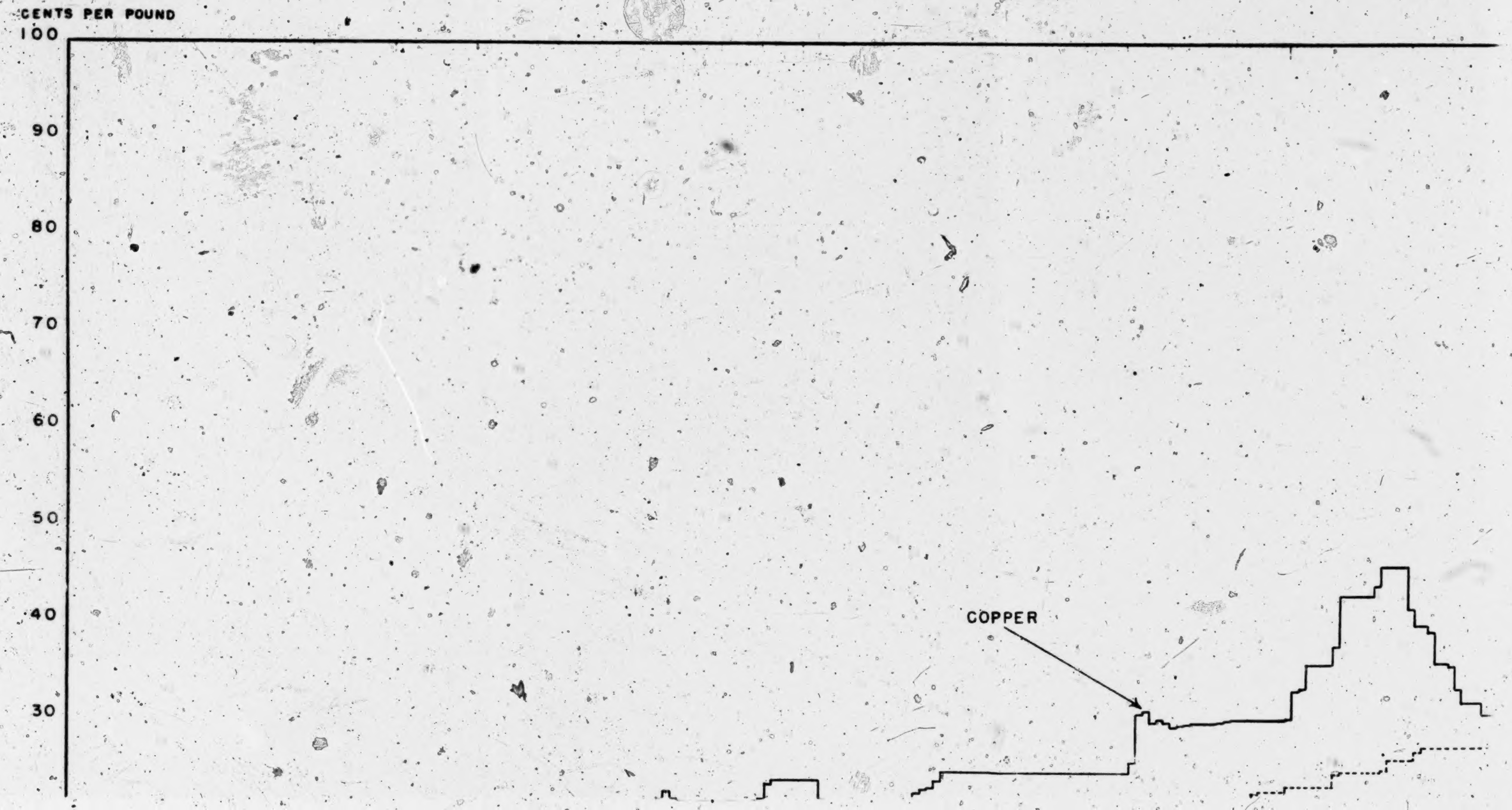
Source: 1960 ALCOA ANNUAL REPORT

[fol. 5923] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 467

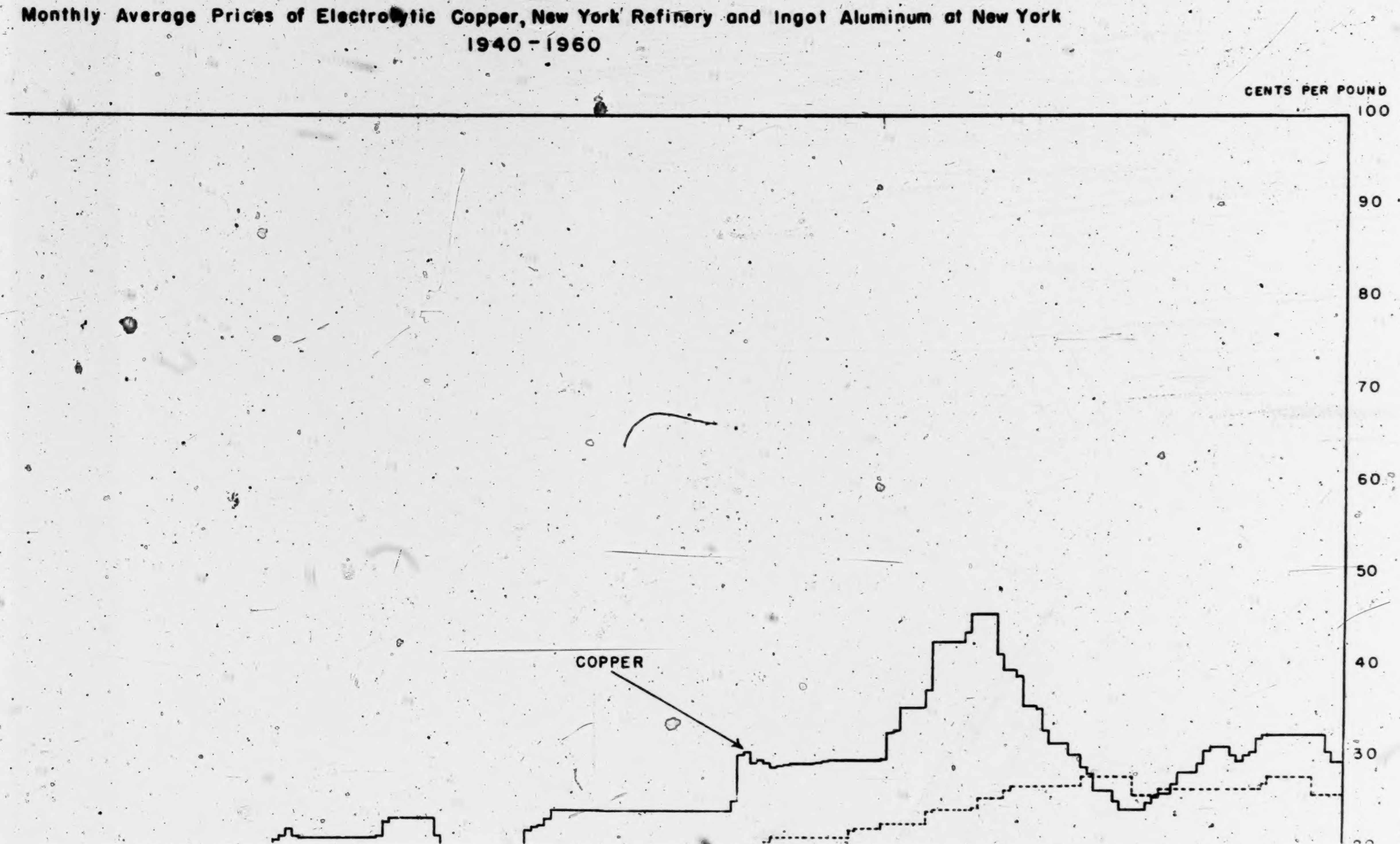
Monthly Average Prices of Electrolytic Copper, New York Refinery and Ingot Aluminum at New York

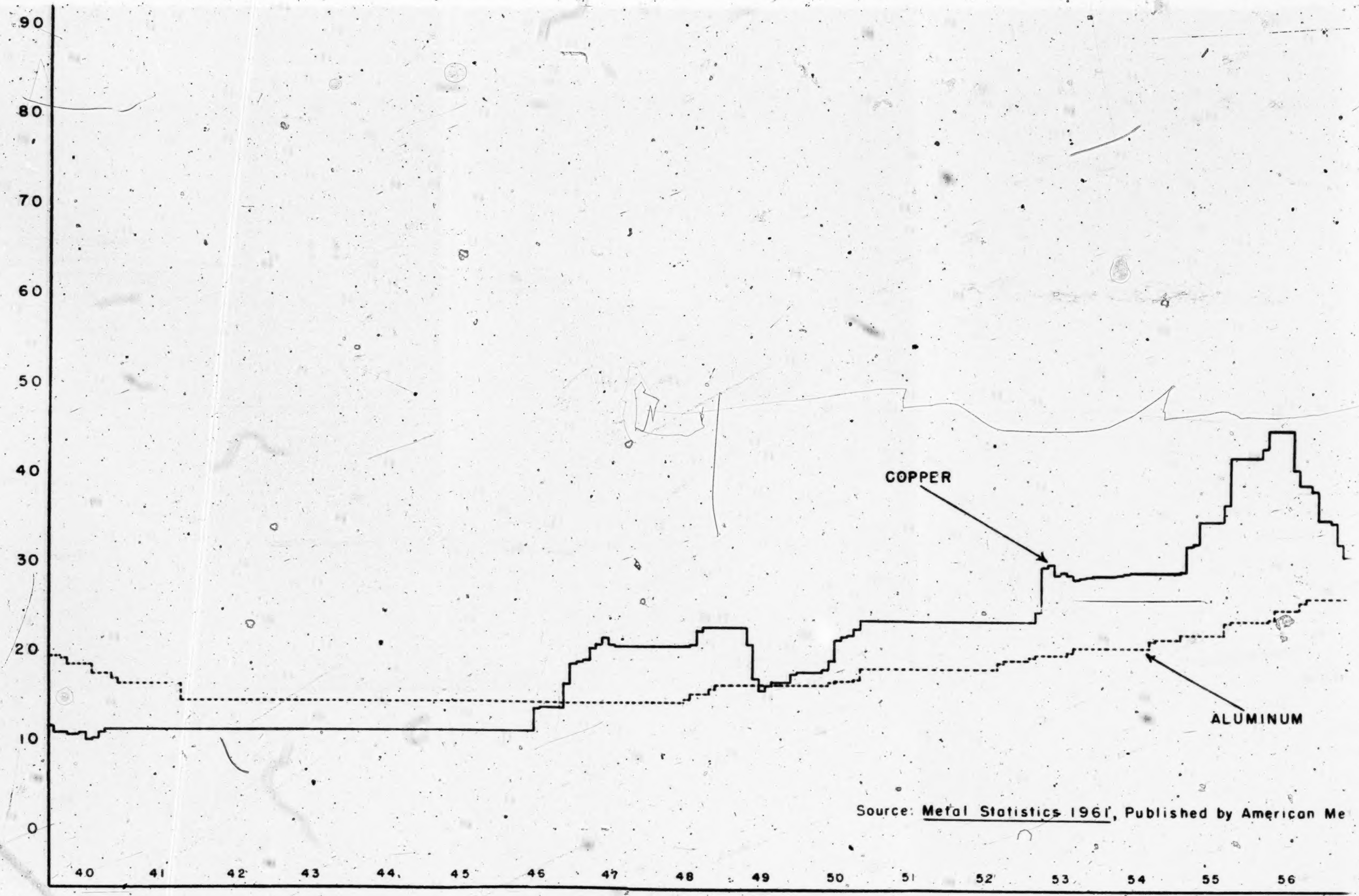
1940 - 1960



[fol. 5923] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 467

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COPPER
ALUMINUM
Source: Metal Statistics 1961, Published by American Me
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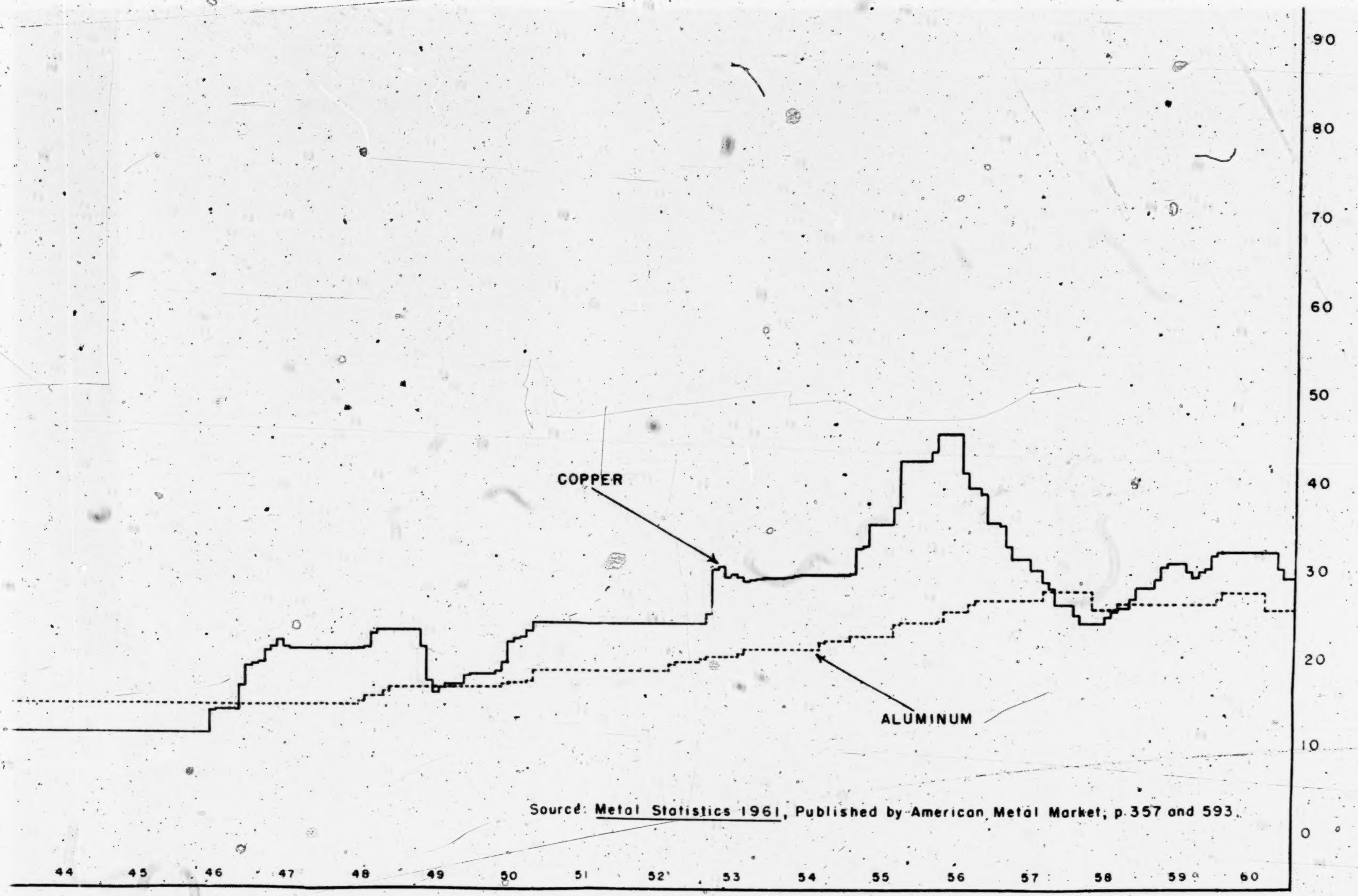

90
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COPPER
ALUMINUM
Source: Metal Statistics 1961, Published by American Metal Market, p. 357 and 593.
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[fol. 5924] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 468

Report on the use of Copper and Aluminum Conductor for Overhead Electric Lines and Underground Electric Cable

By

Electric Utilities in the United States For the Years 1950, 1955 & 1959

By Ellery R. Fosdick, Consulting Engineer,
Washington, D. C.
January 1962

[fol. 5925].

Contents

[fol. 5926] I. Purpose and Scope of This Study

The information contained herein has been prepared for the purpose of showing the extent to which aluminum and copper conductor is used for gross additions to overhead electric lines and underground electric cables in the United States. The study covers the period from 1950 to 1959 inclusive. The extent to which aluminum and copper conductor is employed in overhead electric lines and underground cables by electric utilities is an indication of the use of such conductor for these purposes since almost all of these lines and cables in the United States are constructed by electric utilities.

II. Conclusions

The following conclusions in regard to the use of aluminum conductor, aluminum alloy conductor and aluminum conductor steel reinforced (hereinafter collectively referred to as aluminum conductor) and of copper conductor are based upon information furnished by electric utilities which in 1958 supplied electric service to over half of the ultimate consumers in the United States.

1. Aluminum conductor was the dominant conductor used in 1959 for gross additions to overhead electric lines, being employed for 80.1 percent of these additions.
2. A continuing trend toward an increasing use of aluminum conductor for gross additions to each of the three major categories of overhead electric lines occurred over the period from 1950 to 1959 inclusive, as may be seen in the following tabulation.

fol. 5927]

Overhead Lines	% Aluminum Conductor		
	1950	1955	1959
Transmission Lines	74.4	91.0	94.4
Distribution Lines			
Bare Conductor	35.5	64.4	79.0
Covered & Insulated Conductor	6.5	51.6	77.2
Total[1]	25.0	60.9	80.1

3. The trend toward increasing use of aluminum conductor for overhead electric lines over the period from 1950 to 1959 inclusive was:

a. Found throughout the United States in all seven geographical regions.
b. Present for all three types of electric utility in the electric industry.

4. Copper conductor was the dominant conductor used in 1959 for gross additions to underground electric cables, being employed for 97.7 percent of these additions.
5. No appreciable trend away from the use of copper conductor underground cable occurred over the period from 1950 to 1959 inclusive as may be seen in the following tabulation. Although a small amount of aluminum conductor underground cable was used in 1955 and 1959 only two of the utilities using it indicate an intention to use it again in the foreseeable future.

Underground Cables	% Copper Conductor 1950	1955	1959
Transmission	100.0	100.0	100.0
Distribution	100.0	98.7	97.5
Total[1]	100.0	98.8	97.7

[1] Based upon total gross additions of transmission and distribution conductor.

[fol. 5928] III. Findings

Overhead Conductor

General:

The amount of aluminum conductor compared with the total of aluminum and copper conductor used for gross additions to overhead electric lines of the utilities supplying information (hereinafter referred to as relative use of aluminum conductor) increased substantially during the period covered by this study from 1950 to 1959 inclusive. This increase was accompanied by a corresponding decrease in the relative use of copper conductor. The major part of the increase took place during the period from 1950 to 1955. Although the relative use of aluminum conductor continued to increase during the period from 1955 to 1959 it was at a slightly slower rate. This can be seen in Figure 1.

The same general trend has been present in each of the

seven geographical regions in the continental United States as may be seen in Figure 2.

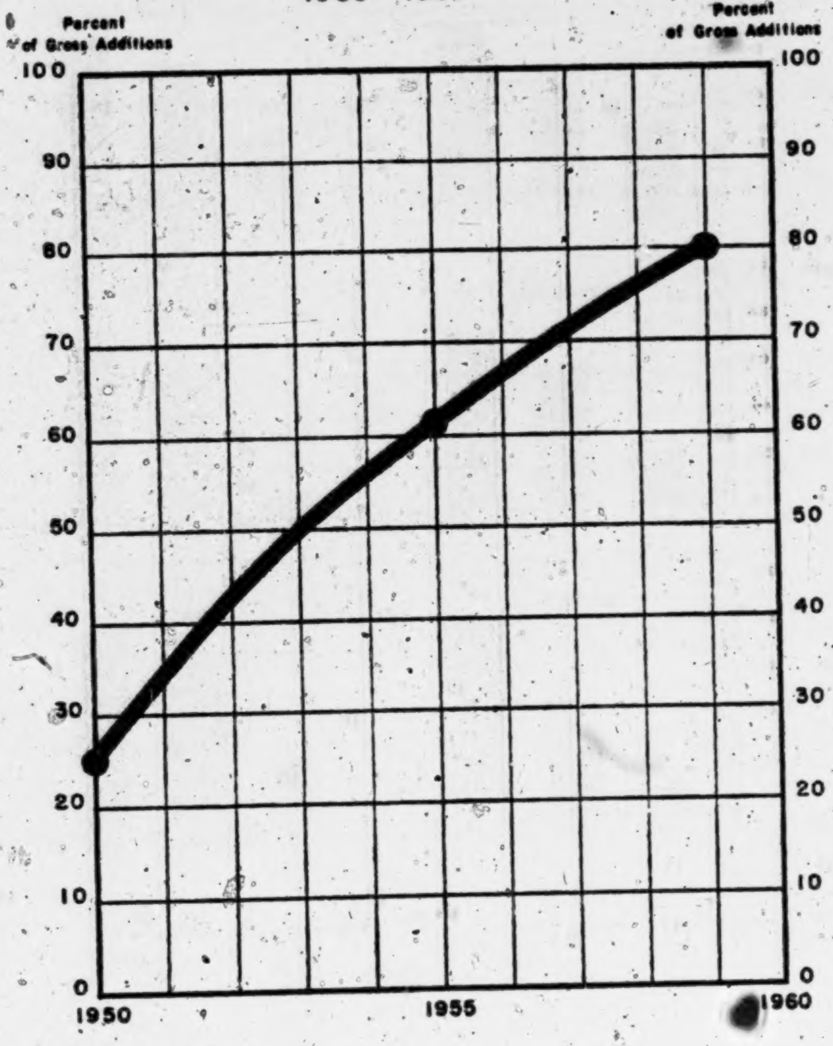
The rapidity of the increase in the relative use of aluminum conductor on overhead electric lines is indicated by the fact that in 1950 this was only 25.0 percent whereas in 1955 it was 60.9 percent and in 1959 it was 80.1 percent. The relative use in 1955 was therefore approximately 2.4 times the relative use in 1950 and the relative use in 1959 was about 3.2 times the relative use in 1950.

Transmission Conductor:

The relative use of aluminum conductor for gross additions to overhead transmission lines of the utilities supplying information increased from 74.4 percent in 1950 to 94.4 percent in 1959 as may be seen from Figure 3. The relative use in 1959 was accordingly approximately 1.3 times the relative use in 1950 which is a com-

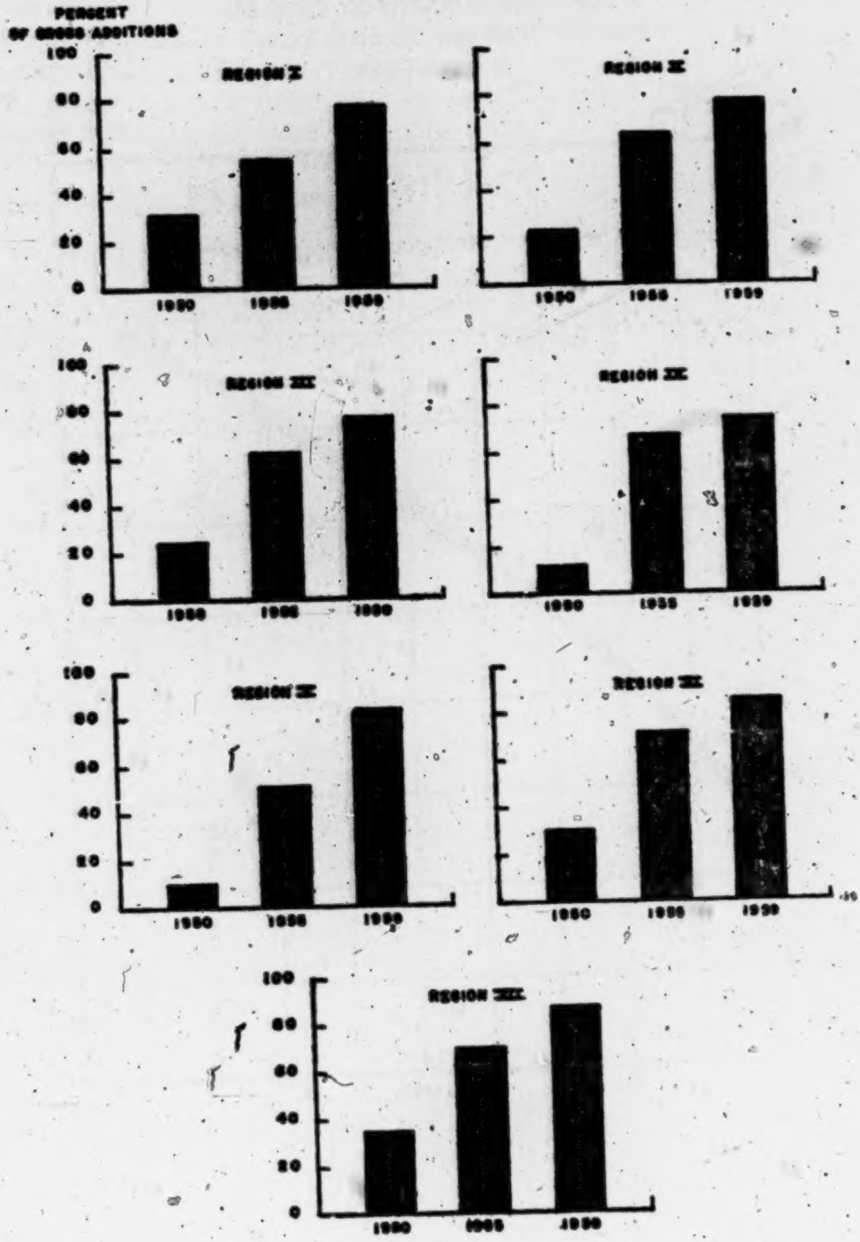
[fol. 5929]

Figure I
Trend in Use of Aluminum Conductor on All Overhead Electric Lines 1950 – 1959



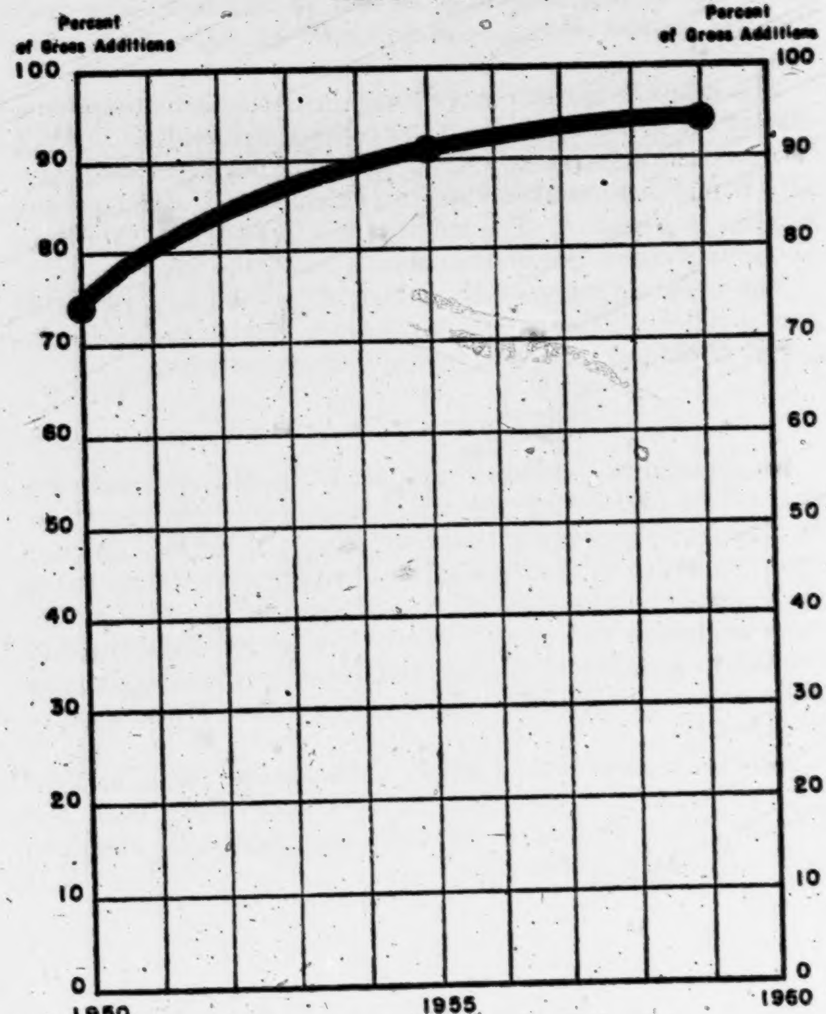
[fol. 5930]

Figure 2
Relative Use of Aluminum Conductor
on Overhead Electric Lines in Each Region
1950–1959



[fol. 5931]

Figure 3
Trend in Use of Aluminum Conductor
on Overhead Electric Transmission Lines
1950 – 1959



[fol. 5932] paratively small increase. This is due to the fact that aluminum conductor has been used to an increasing extent on overhead electric transmission lines until the area left for expanded use is small.

Overhead Distribution Conductor:

The relative use of bare aluminum conductor for gross additions to overhead distribution lines of the utilities supplying information increased from 35.5 percent in 1950 to 79.0 percent in 1959 as may be seen in Figure 4. The relative use in 1959 was accordingly about 2.2 times the relative use in 1950.

The relative use of covered and insulated aluminum conductor for gross additions to overhead distribution lines of the electric utilities supplying information increased rapidly from 6.5 percent in 1950 to 77.2 percent in 1959 as may be seen in Figure 5. The relative use in 1959 was therefore about 11.9 times the relative use in 1950.

The percentages used in making Figures 1 to 5 inclusive are shown in Table 1. These percentages have been computed from data supplied by the electric utilities.

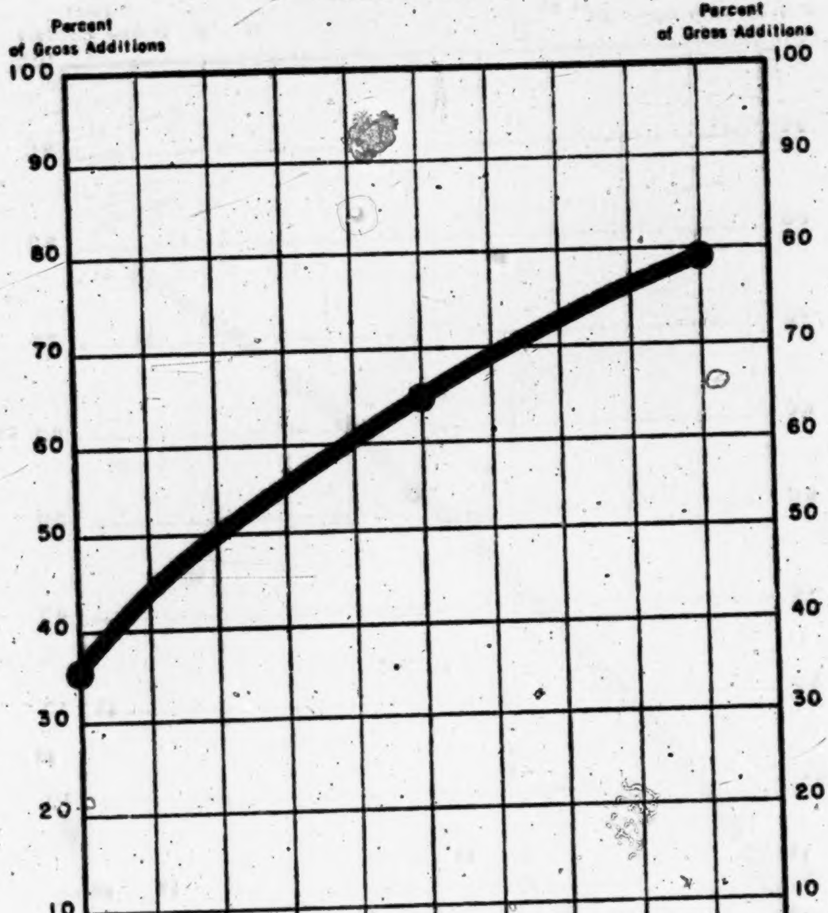
Underground Conductor

No aluminum conductor was used for underground electric cables in 1950 by the utilities supplying information. In 1955 some aluminum conductor was used for this purpose by two utilities located in Region I making the relative usage in the continental United States 1.2 percent. In 1959 aluminum conductor was used for this purpose by seven utilities located in 4 different regions making the relative usage in the continental United States 2.3 percent as may be seen in Figure 6.

Aluminum conductor used in underground cable in 1955 and 1959 was for distribution with none being used for transmission. The usage of aluminum conductor resulted in a very slight decrease in

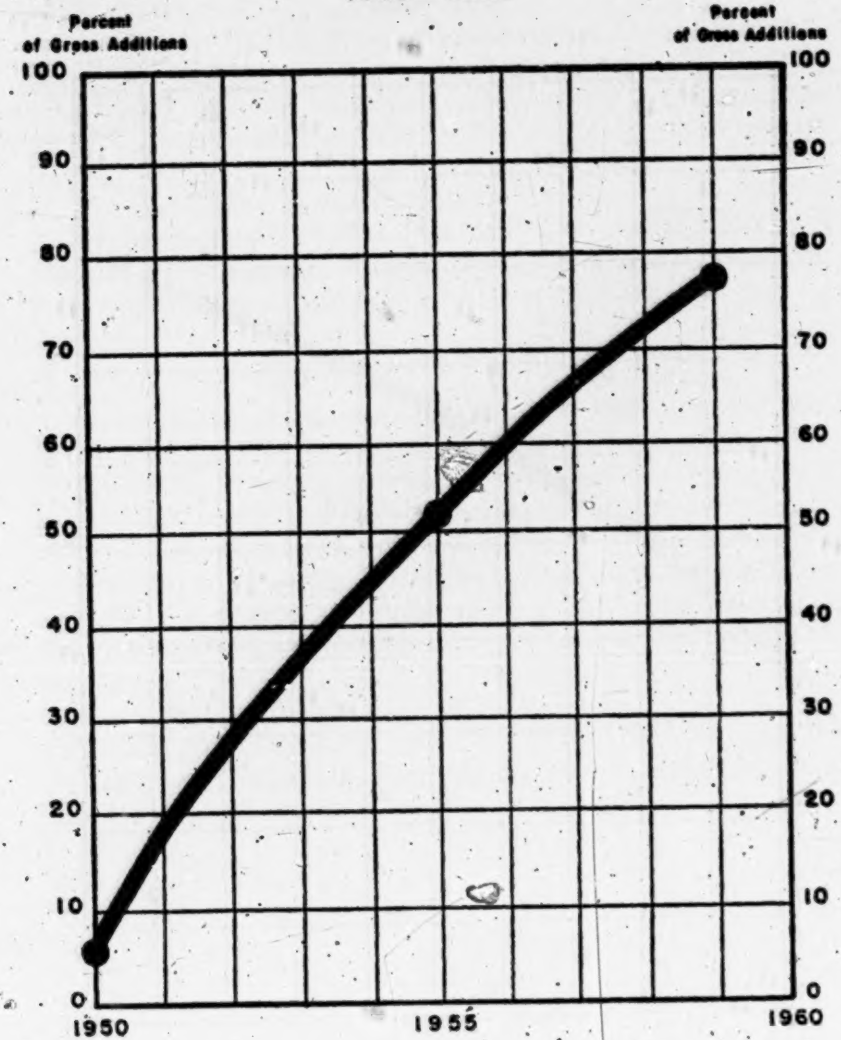
[fol. 5933]

Figure 4
Trend in Use of Bare Aluminum Conductor
on Overhead Electric Distribution Lines
1950—1959



[fol. 5934]

Figure 5
Trend in Use of Covered and Insulated Aluminum Conductor on Overhead Electric Distribution Lines
1950—1959



[fol. 5935]

Table I

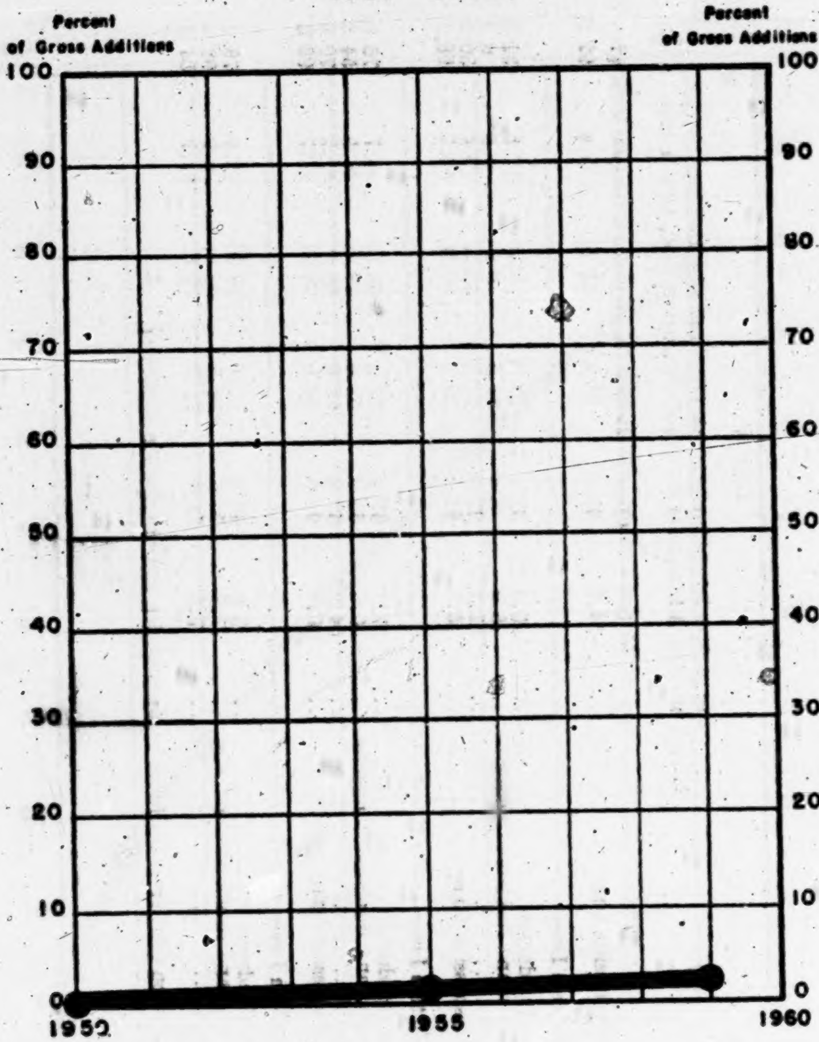
Use of Aluminum Conductor on Overhead Electric Lines
Percent of Gross Additions of Overhead Conductor, 1950, 1955 & 1959

Year	Region I	Region II	Region III	Region IV	Region V	Region VI	Region VII	Total
1950 Transmission Lines	54.5	83.4	74.3	67.0	50.4	92.6	84.2	74.4
Distribution Lines								
Bare Conductor	40.4	32.1	23.9	5.0	17.5	32.0	55.8	35.5
Covered and Insulated Conductor	15.9	8.4	14.5	0.6	0.4	0.4	0.4	6.5
Total (1)	31.1	22.6	24.2	11.5	10.4	30.2	35.3	25.0
1955 Transmission Lines	75.5	93.5	96.5	99.0	86.7	98.1	94.3	91.0
Distribution Lines								
Bare Conductor	57.3	67.9	53.3	58.5	48.7	76.6	80.2	64.4
Covered and Insulated Conductor	50.6	53.9	53.4	72.7	44.5	54.5	53.1	51.6
Total (1)	54.2	63.3	62.0	66.9	51.2	70.8	70.3	60.9
1959 Transmission Lines	90.9	94.5	94.0	75.2	97.7	99.2	99.3	94.4
Distribution Lines								
Bare Conductor	73.6	69.4	74.4	78.9	82.4	78.4	86.3	79.0
Covered and Insulated Conductor	77.9	70.6	72.5	66.4	79.9	92.4	81.4	77.2
Total (1)	77.2	73.0	76.7	73.6	82.9	84.9	87.0	80.1

(1) Based upon total gross additions of transmission and distribution conductor.

[fol. 5936]

Figure 6
Trend in Use of Aluminum Conductor in Underground Electric Cables 1950—1959



[fol. 5937] the use of copper conductor as may seen in Figure 7.

The percentages used in making Figure 7 are shown in Table 2 which also shows the percentages for each of the seven geographical region and for transmission and distribution cable separately. The percentages have been computed from data supplied by the utilities. The percentages in Figure 6 are the difference between the percentage in Figure 7 and 100 percent.

The information supplied by electric utilities indicates there is no basis at the present time to expect widespread usage of aluminum conductor for underground electric cable in the continental United States. Only one of the utilities that used this type of conductor has indicated an intention to use more of it. One other utility expects no change in the amount of aluminum conductor used for underground cable and all the others indicate they do not intend to use it in the future.

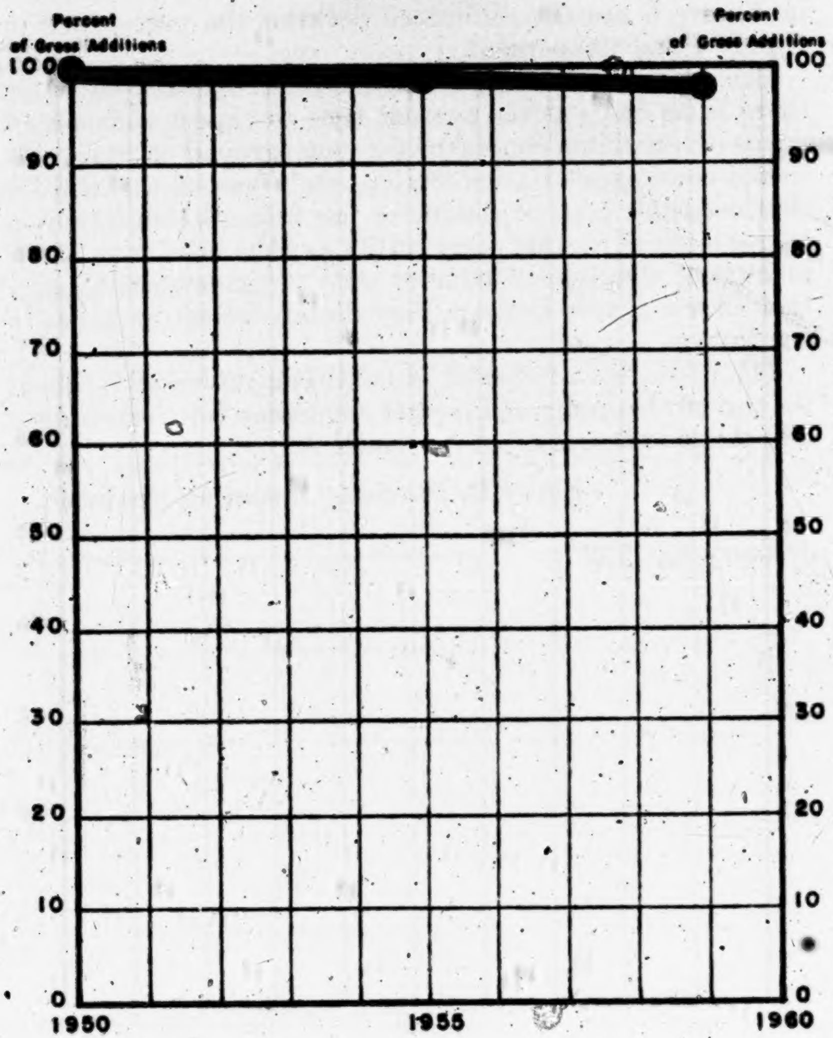
The procedures followed in obtaining information about the use of aluminum and copper conductor for electric lines and cables is discussed in Appendix A.

Ellery R. Fosdick, Consulting Engineer.

January 15, 1962

[fol. 5938]

Figure 7
Trend in Use of Copper Conductor in Underground Electric Cables 1950—1959



[fol. 5939]

Table 2

Use of Copper Cable on Underground Electric Lines
Percent of Gross Additions of Underground Cable, 1950, 1955 & 1959

Year	Region I	Region II	Region III	Region IV	Region V	Region VI	Region VII	Total
1950 Transmission Cable	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Distribution Cable	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (1)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1955 Transmission Cable	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Distribution Cable	98.0	100.0	100.0	100.0	100.0	100.0	100.0	98.7
Total (1)	98.1	100.0	100.0	100.0	100.0	100.0	100.0	98.8
1959 Transmission Cable	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Distribution Cable	99.3	100.0	99.9	100.0	85.6	100.0	99.3	97.5
Total (1)	99.3	100.0	99.9	100.0	86.0	100.0	99.4	97.7

(1) Based upon total gross additions of transmission and distribution conductor.

[fol. 5940] Appendix A

[fol. 5941] *Procedure Followed in Making This Study*
Definition of Terms and Expressions

The following definitions of terms and expressions used subsequently herein were approved by the American Standards Association August 12, 1941.

A *wire* is a slender rod or filament of drawn metal.

A *conductor* is a wire or combination of wires not insulated from one another, suitable for carrying electric current.

A *stranded conductor* is a conductor composed of a group of wires, or any combination of groups of wires.

Note: The wires in a stranded conductor are usually twisted or braided together.

A *cable* is either a stranded conductor (single conductor cable), or a combination of conductors insulated from one another (multiple conductor cable).

A *bare conductor* is a conductor not covered with insulating material.

Insulated means separated from other conducting surfaces by a dielectric permanently offering a high resistance to the passage of current and to disruptive discharge.

Note: When any object is said to be insulated, it is understood to be insulated in a suitable manner for the conditions to which it is subjected.

An *open-wire* circuit is a circuit made up of conductors separately supported on insulators.

Note: The conductors are usually bare wire, but they may be insulated by some form of continuous insulation. The insulators are usually supported by crossarms or brackets on poles.

An *aluminum conductor* is a conductor made wholly of aluminum.

[fol. 5942] An *aluminum steel conductor* is a composite conductor made up of a combination of aluminum and steel wires. In the usual construction the aluminum wires surround the steel.

Alternating-current transmission is the transfer of electric energy by alternating current from its source to one or more main receiving stations for subsequent distribution.

Note: Generally a voltage is employed which is higher than that which would be delivered or utilized by electrical machinery. Transformers of a capacity comparable to that of the line are usually employed as links between the high voltage transmission and lower voltage used for distribution or utilization.

Alternating-current distribution is the supply to points of utilization of electric energy by alternating current from its source or one or more main receiving stations.

Note: Generally a voltage is employed which is not higher than that which could be delivered or utilized by rotating electric machinery. Step-down transformers with a capacity much smaller than that of the line are usually employed as links between the moderate voltage of distribution and the lower voltage of the consumers apparatus.

Primary distribution mains are the conductors which feed from the center of distribution to direct primary loads or to transformers which feed secondary circuits.

Secondary distribution mains are the conductors connected to the secondaries of distribution transformers from which consumers' services are supplied.

The Service drop is that portion of the overhead service conductors between the last pole and the premises served extending from the last pole to the junction with the service entrance conductors.

[fol. 5943] *Source of Information*

Electric utilities are the best source of information regarding the use of copper and aluminum conductor for overhead lines and underground cables as almost all of these lines and cables in the United States are constructed by the utilities. In obtaining information from the electric utilities it was necessary to establish selection criteria that would keep the work within reasonable limits. As of January 1, 1959, there were 3,355 operating electric utilities in the continental United States serving communities with a population of 500 and over.* A total of 93 electric utilities were selected.

* McGraw-Hill Directory of Electric Utilities—1959.

Bases Used in Selecting Electric Utilities

General

Information about the amount and kind of overhead and underground electrical conductor used by electric utilities in the United States was not readily available. The largest electric utilities of each type in the 48 continental states of the United States were selected as a source of information because:

(1) They usually keep good records regarding matters such as the type and amount of copper and aluminum conductor used and were considered likely to have the desired information readily available.

(2) A relatively small number of large electric utilities supply service to a substantial proportion of the nation's customers, making it possible to obtain the desired information by fewer inquiries than would be the case if small utilities were selected.

[fol. 5944] Installed generating capacity was used as a basis for selecting the largest privately-owned and publicly-owned non-Federal electric utilities. This basis indicates in a general way the relative size of the large utilities since they usually generate most of their power requirements in their own plants. Furthermore electric utilities with a large amount of generating capacity generally require a relatively large amount of electrical conductor for the delivery of power to customers.

Publicly-owned Federal electric utilities were not included in the group from which selections were made. These utilities are concerned almost exclusively with the generation and/or transmission of electric energy to other electric utilities and use only a relatively small amount of distribution conductor.

The number of miles of electric line energized was used as a basis for selecting the largest rural electric cooperatives instead of installed generating capacity. Most of these cooperatives have little or no generating capacity but instead purchase part or all of their power requirements from others. The number of customers served was not used as a basis of selection since this is not a good indication of the

size of a rural electric cooperative. The density of customers served by rural electric cooperative lines varies with the nature of the areas served.

Data used in selecting electric utilities were for the year 1958 as this was the latest available at the time the work was started. Data used in selecting the privately owned electric utilities were taken from the 1958 report on "Statistics of Electric Utilities in the United States" for privately owned utilities published by the Federal Power Commission. Data used in selecting the publicly owned electric utilities were taken from the 1958 report on "Statistics of Electric Utilities in the United States" for publicly owned utilities published by the Federal Power Commission. Data used in [fol. 5945] selecting the rural electric cooperatives were taken from the "Annual Statistical Report" for 1958 of rural electrification borrowers, published by the Rural Electrification Administration.

These statistical reports cover a large proportion of the electric utility industry in the United States. The electric utilities listed in the reports had an average of 53,485,000 ultimate consumers in the United States in 1958 or approximately 96 percent of the total average of 55,689,790* ultimate consumers served by electric utilities.

In the Federal Power Commission report on privately owned electric utilities is the following statement. "It is estimated that these larger companies comprise, both on the basis of assets and of revenues in excess of 98 percent of the privately owned electric light and power industry".

The Federal Power Commission report on publicly owned electric utilities contains the following paragraph. "The electric utilities included in the summary statements which follow are limited to the larger publicly owned electric utilities exclusive of federally owned projects, which filed with the Commission annual reports for 1958. The proportion of the non-Federal publicly owned division of the electric utility industry represented by such utilities is estimated to be approximately 70 percent both on the basis of electric

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* Average of number of ultimate consumers computed from number as of December 31, 1957 and December 31, 1958 given in Table 26 of Edison Electric Institute No. 27 Publication No. 60-14.

plant investment and of sales to ultimate consumers, and approximately 60 percent on the basis of revenues from ultimate consumers and number of ultimate consumers served, respectively".

The Rural Electrification Administration report on rural electrification cooperatives lists all such cooperatives in the United States, Alaska, Puerto Rico and the Virgin Islands, and supplies certain data for all the active energized borrowers. Only the active energized distribution type of bor- [fol. 5946] rowers in the United States were considered in selecting rural electric cooperatives for this study. The borrowers used in selecting cooperatives for this study comprise approximately 94 percent of all energized distribution type rural electric cooperatives in the continental United States. Former borrowers were not considered in the selection as no information about them was available. The power type of borrowers were not considered as they are concerned almost exclusively with the generation and transmission of electric energy to distribution type borrowers and use little distribution conductor. Refrigeration type of borrowers were not considered as they operate cold storage plants and use little electrical conductor.

Selection Criteria

Privately owned utilities

The largest electric utility serving domestic customers directly based upon the amount of generating capacity installed as of December 31, 1958, was selected in each state. All other smaller utilities were selected in each state which had an installed generating capacity of:

a. 1,000 MW or more or,
b. 75% or more of the installed generating capacity of the largest utility.

Publicly owned utilities include municipal systems, public utility districts, irrigation districts, county systems, mutual systems, Federal systems and state authorities.

The largest non-Federal publicly owned electric utility serving domestic customers directly based upon the amount of generating capacity installed as of December 31, 1958,

was selected in each of the seven geographical regions into which the United States has been divided by the Federal Power Commission. All other publicly owned non-Federal electric utilities were selected which had an installed generating capacity of 100 MW or more.

[fol. 5947] Rural Electric Cooperatives

The two largest rural electric cooperatives serving domestic customers directly based upon the miles of electric line energized as of December 31, 1958, were selected in each of the seven geographical regions into which the United States has been divided by the Federal Power Commission.

Electric Utilities Selected

A total of 93 electric utilities from which to request information were selected as a result of applying the selection criteria previously described. These include 66 privately owned utilities, 13 publicly owned utilities and 14 rural electric cooperatives. Utilities in each of these groups are well dispersed throughout the continental United States being located in each of the 7 geographical regions into which the United States has been divided by the Federal Power Commission as may be seen in the following summary. The utilities selected are also well distributed according to size based upon the amount of installed generating capacity with the largest number being in the small size group which has the largest number of utilities.

The electric utilities selected have 59 percent of the installed generating capacity in the United States based upon the data contained in the annual statistical reports for 1958 of the Federal Power Commission and Rural Electrification Administration and 63 percent of the ultimate consumers. That is, the utilities selected for this study have a combined installed generating capacity of 83,248,000 KW out of a total of 141,642,000 KW and 33,882,000 ultimate consumers out of a total of 53,485,000. The installed generating capacity of the electric utilities selected and the number of ultimate consumers served by them is shown below for each type of utility:

[fol. 5948]

Summary of 93 Electric Utilities Selected

Generating Capacity	Number of Utilities
KW in millions	
0.00 to 0.25	31
0.26 to 0.50	12
0.51 to 1.0	19
1.1 to 2.0	19
2.1 to 3.0	7
3.1 to 4.0	3
4.1 & over	2
Total	93
Percent of total generating capacity in the United States (1)	59%
Number of Customers	
Percent of total number of ultimate electric consumers in the United States (1)	63%

Ownerchip	Number of Utilities
Private	66
Public	13
Rural Electric Cooperative	14
Total	93

Geographic Location		Number of Utilities
Region I	Northeast	22
II	Great Lakes	15
III	North Central	12
IV	Northwestern	10
V	Southwestern	13
VI	South Central	9
VII	Southeastern	12
Total		93

(1) Exclusive of small utilities not listed in published statistics of the Federal Power Commission and of electric cooperatives for which no data are given in published statistics of the Rural Electrification Administration.

[fol. 5949]	Privately Owned	Publicly Owned	R.E.A. Borrowers	Total
Installed Generating Capacity—December 31, 1958				
Reported by FPC and REA MW.....	112,687	27,857(1)	1,098(2)	141,642
Selected MW..............	79,004	4,235	9	83,248
%................	70	15	—	59
Ultimate Consumers—Average for 1958				
Reported by FPC and REA Thous....	44,853	4,441(3)	4,191(4)	53,485
Selected Thous..........	31,876	1,843	163	33,882
%................	71	42	4	63

(1) Includes Federal Projects.
(2) Includes Power Type Borrowers.
(3) Includes ultimate consumers served by Federal Projects.
(4) Includes ultimate consumers served by Power Type borrowers.

The 93 electric utilities from which information was requested are listed in Appendix B showing the geographical region in which they are located, installed generating capacity and number of ultimate consumers for each and in addition the miles of line for rural electric cooperatives.

[fol. 5960] Procedure Used in Obtaining Information from Electric Utilities

A set of four schedules was transmitted to each of the 93 electric utilities selected. These schedules requested that information be supplied regarding the gross additions of overhead conductor and underground conductor to electric utility plant (Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance), expected changes in the amount of aluminum conductor used and limitations or restrictions to its use. The four schedules were designed to elicit objective factual information from officials of each utility. All of the 93 electric utilities to which the schedules were sent responded with varying degrees of completeness.

Approval of the four schedules and the letter of transmittal by the Bureau of the Budget was obtained as required under Circular A-40 dated October 24, 1951 that was promulgated under the authority of the Federal Reports Act of 1942. The Bureau of the Budget reviewed the schedules and letter in the light of their intended use to obtain infor-

mation from electric utilities to be selected by the criteria established.

A copy of the letter from the Bureau of the Budget dated September 28, 1960, approving the schedules and the letter of transmittal is attached as Appendix C. A copy of the letter used in transmitting the schedules and a copy of each of the four schedules sent to the electric utilities are attached as Appendix D.

The preparation of the four schedules for use by the electric utilities in supplying information regarding their gross additions of overhead electrical conductor and underground electrical conductor was simplified by the fact that terminology relating to much of the electric utility business in the United States has been standardized. Generally accepted terminology was used where ever practicable in the [fol. 5951] preparation of the schedules so as to facilitate to the maximum extent a correct understanding of the information desired.

Schedule I was for the purpose of obtaining information regarding the gross additions of overhead electrical conductor and Schedule II for gross additions of underground electrical conductor in each of the years 1950, 1955 and 1959. This information was to be supplied separately on each schedule for transmission conductor and distribution conductor with a further breakdown of overhead distribution conductor between bare conductor and insulated or covered conductor. The gross additions were to be given in thousands of feet of single conductor as it was thought this would be generally available and would provide a basis for indicating the relative usage of aluminum conductor compared with copper conductor.

Schedule III relating to overhead lines and Schedule IV relating to underground cables requested information about expected future changes in the proportion of gross additions of aluminum conductor to gross additions of copper conductor and also the limitations or restrictions that may exist in connection with using aluminum conductor.

The information to be supplied on Schedules III and IV was for the purpose of determining whether trends shown by the data supplied on Schedules I and II might be expected to continue or change. The questions were phrased to facili-

tate brief explicit answers to the maximum extent practicable.

The information to be supplied by the electric utilities on the schedules was consistent with the needs. Data regarding the gross additions of conductor to be submitted on Schedules I and II was requested for the years 1950, 1955 and 1959 as this period was sufficiently long and three different years in the period were adequate to indicate a trend.

[fol. 5952]

Appendix B

[fol. 5953]

Privately Owned Electric Utilities Selected

Region I.—Northeastern

State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumers
1. Conn.	Berlin	Connecticut Light & Power Co. 791	325
2. Del.	Wilmington	Delaware Power & Light Co. 313	106
3. D. C.	Washington	Potomac Electric Power Co. 1,029	338
4. Maine	Augusta	Central Maine Power Co. 548	237
5. Md.	Baltimore	Baltimore Gas & Electric Co. 956	520
6. Mass.	Boston	Boston Edison Co. 926	522
7. N. H.	Manchester	Public Service Co. of N. H. 317	139
8. N. J.	Newark	Public Service Electric & Gas Co. 2,554	1,381
9. N. Y.	Mineola	Long Island Lighting Co. 1,038	540
	New York	Consolidated Edison Co., of N.Y. Inc. 4,071	2,788
	Syracuse	Niagara Mohawk Power Corp. 3,073	1,068
10. Pa.	Allentown	Pennsylvania Power & Light Co. 1,381	702
	Greensburg	West Penn Power Co. 1,058	373
	Philadelphia	Philadelphia Electric Co. 2,460	1,133
	Pittsburgh	Duquesne Light Co. 1,361	466
11. R. I.	Providence	The Narragansett Electric Co. 371	200
12. Vt.	Rutland	Central Vermont Public Service Corp. 65	61
13. Va.	Richmond	Virginia Electric & Power Co. 1,849	711
14. W. Va.	Roanoke, Va.	Appalachin Power Co. 2,111	481
Total—19 Utilities		26,272	12,091

[fol. 5954] Privately Owned Electric Utilities Selected

Region II.—Great Lakes,

State	City of Headquarters	Name of Utility / Installed MW	M Ult. Consumers
1. Ill.	Chicago	Commonwealth Edison Co. 3,492	1,961
2. Ind.	Ft. Wayne	Indiana & Michigan Electric Co. 977	277
	Plainfield	Public Service Co. of Indiana, Inc. 1,227	367
3. Ky.	Louisville	Louisville Gas & Electric Co. 940	186
4. Mich.	Detroit	Detroit Edison Co. 3,174	1,239
	Jackson	Consumers Power Co. 2,013	836
5. Ohio	Akron	Ohio Edison Co. 1,629	560
	Canton	Ohio Power Co. 2,099	448
	Cincinnati	Cincinnati Gas & Electric Co. 1,091	339
	Cleveland	Cleveland Electric Illuminating Co. 1,833	533
6. Wisc.	Milwaukee	Wisconsin Electric Power Co. 1,318	601
Total—11 Utilities		19,793	7,347

[fol. 5955] Privately Owned Electric Utilities Selected

Region III.—North Central

State	City of Headquarters	Name of Utility / Installed MW	M Ult. Consumers
1. Iowa	Des Moines	Iowa Power & Light Co. 376	164
2. Kan.	Topeka	Kansas Power & Light Co. 445	179
	Wichita	Kansas Gas & Electric Co. 457	167
3. Minn.	Minneapolis	Northern States Power Co. 1,223	669
4. Mo.	Kansas City	Kansas City Power & Light Co. 884	254
	St. Louis	Union Electric Co. 1,509	574
5. Neb.	....	(No privately owned utilities in the State of Nebraska)	
6. N. D.	Fergus Falls, Minn.	Otter Tail Power Co. 123	98
	Minneapolis, Minn.	Montana-Dakota Utilities Co. 154	72
7. S. D.	Rapid City	Black Hills Power & Light Co. 62	28
Total—9 Utilities		5,233	2,205

[fol. 5956] Privately Owned Electric Utilities Selected

Region IV.—Northwestern

State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumers
1. Idaho	Boise	Idaho Power Company 620	130
2. Mont.	Butte	Montana Power Company 536	144
3. Ore.	Portland	Pacific Power & Light Company 579	297
4. Wash.	Spokane	Washington Water Power Company 355	145
5. Wyo.	Cheyenne	Cheyenne Light Fuel & Power Co. 6	16
	Frontier	Lincoln Service Corporation 6	2
Total—6 Utilities		2,102	734

[fol. 5957] Privately Owned Electric Utilities Selected

Region V.—Southwestern

State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumers
1. Ariz.	Phoenix	Arizona Public Service Co. 432	156
2. Calif.	Los Angeles	Southern California Edison Co. 2,814	1,478
	San Francisco	Pacific Gas & Electric Co. 4,986	1,824
3. Colo.	Denver	Public Service Co. of Colorado 709	298
4. Nev.	Las Vegas	Southern Nevada Power Co. 119	32
5. N. M.	Albuquerque	Public Service Co. of New Mexico 172	88
6. Utah	Salt Lake City	Utah Power & Light Co. 706	200
Total—7 Utilities		9,938	4,076

[fol. 5958] Privately Owned Electric Utilities Selected

Region VI.—South Central

State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumers
1. Ark.	Little Rock	Arkansas Power & Light Co. 760	287
2. La.	New Orleans	Louisiana Power & Light Co. 715	225
	New Orleans	New Orleans Public Service, Inc. 543	177
3. Okla.	Oklahoma City	Oklahoma Gas & Electric Co. 853	328
	Tulsa	Public Service Co. of Oklahoma 793	246
4. Texas	Houston	Houston Lighting & Power Co. 1,862	447
Total—6 Utilities		5,526	1,710

[fol. 5959] Privately Owned Electric Utilities Selected

Region VII.—Southeastern

State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumers
1. Ala.	Birmingham	Alabama Power Company 1,906	605
2. Fla.	Miami	Florida Power & Light Co. 1,354	655
3. Ga.	Atlanta	Georgia Power Co. 1,919	666
4. Miss.	Jackson	Mississippi Power & Light Co. 407	175
5. N. C.	Charlotte	Duke Power Company 2,783	1,012
	Raleigh	Carolina Power & Light Co. 1,180	403
6. S. C.	Columbia	South Carolina Electric & Gas Co. 591	177
7. Tenn.	Kingsport	Kingsport Utilities, Inc.	20
Total—8 Utilities		10,140	3,713

[fol. 5960] Publicly Owned Electric Utilities Selected

Region	State	City of Headquarters	Name of Utility Installed MW	M Ult. Consumer
I.	N. Y.	Jamestown	Jamestown Municipal Electric Dept. 55	19
II.	Mich.	Lansing	Board of Water and Electric Light Commissioners 195	45
	Ohio	Cleveland	Cleveland Dept. of Light & Power 138	58
III.	Kan.	Kansas City	Board of Public Utilities 213	42
IV.	Wash.	Seattle	Seattle Dept. of Lighting 693	228
		Tacoma	Tacoma Dept. of Public Utilities (Light Div.) 297	63
V.	Ariz.	Tempe	Salt River Project Agricultural Improvement & Power District 448	64
	Calif.	Imperial	Imperial Irrigation District 190	31
		Los Angeles	Los Angeles Dept. of Water & Power 1,233	884
		Pasadena	Pasadena Municipal Light & Power Dept. 167	48
VI.	Texas	San Antonio	City Public Service Board 391	171
VII.	S. C.	Moncks Corner	S. C. Public Service Authority 215	16
	Tenn.	Memphis	Memphis Light Gas & Water Div.	174
Total—13 Utilities			4,235	1,843

[fol. 5961] Rural Electric Cooperatives Selected

Region	State	City of Headquarters	Name of Cooperative / Miles of line chargized	M Ult. Consumer
I.	Md. 7	Denton	Choptank Electric Cooperative, Inc. 3,141	13
	Va. 27	Crewe	Southside Electric Cooperative 4,322	15
II.	Ill. 36	Newton	Norris Electric Cooperative 3,346	11
	Ky. 35	Bowling Green	Warren Rural Elec. Cooperative Corp. 3,958	17
III.	Minn. 57	Pelican Rapids	Lake Region C-Op Electrical Assn. 4,318	10
	N. D. 19	Grand Forks	Nodak Rural Elec. Cooperative, Inc. 5,560	9
IV.	Mont. 15	Lewistown	Fergus Electric Cooperative, Inc. 2,515	3
	Wash. 18	Spokane	Inland Power & Light Co. 3,726	8
V.	Colo. 17	La Junta	Southeast Colo. Power Assn. 4,370	6
	Colo. 37	Limon	Mountain View Elec. Assn. 2,795	4
VI.	Ark. 9	Jonesboro	Craighead Elec. Cooperative Corp. 4,055	16
	Texas 100	Austin	Lower Colo. River Elec. Coop. Inc. 5,226	15
VII.	Fla. 14	Keystone Heights	(1)Clay Electric Cooperative Inc. 3,789	15
	Miss. 40	Taylorsville	Southern Pine Elec. Power Assn. 5,918	21
Total—14 Utilities			57,039	163

(1) The only cooperative selected which has installed generating capacity. This is 9 MW.

[fol. 5962] Appendix C

[fol. 5963] Executive Office of the President
Bureau of the Budget
Washington 25, D. C.

Notice of Approval of Report Form

Date: September 28, 1960.

To: Mr. S. A. Andretta
Administrative Assistant Attorney General
Department of Justice
Subject: Agency's Form No.
Title: Form Letter and Schedules Attached Thereto (Use of Aluminum and Copper Wire and Cable)

The above-named form is hereby approved in accordance with Circular A-40 issued by the Bureau of the Budget under the Federal Reports Act of 1942.

The following notation of approval must be shown in the upper right-hand corner of the form:

Budget Bureau No. 43-6005
Approval Expires December 31, 1960

Will you please transmit to this Office two copies of this form after printing or other multicopying?

/s/ David E. Cohn, David E. Cohn, Clearance Officer,
Office of Statistical Standards.

[fol. 5964] Appendix D

[fol. 5965] United States Department of Justice
Washington, D. C.

Budget Bureau No. 43-6005
Approval Exp. 12-31-60

RAB:CLW
60-0-37-256

The Department of Justice is seeking information as to the relative use by electric utilities of aluminum and copper conductor for new construction and for replacement. This information is necessary with respect to pending litigation, in which neither your utility nor any other electric utility is a party. We are enclosing schedules setting out the specific information desired, and it will be appreciated if you will cooperate in furnishing on these schedules the information requested.

In order that we may obtain the necessary information within time limitations imposed by the afore-mentioned litigation, your return of the completed schedules with the appropriate signature by October 31, 1960, will be appreciated.

Sincerely yours, Robert A. Bicks, Assistant Attorney General, Antitrust Division.

Enclosures

[fol. 5966] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Name of Utility

Address of Utility

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
A. Transmission Lines...............	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)...	xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx	xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx	xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx xxxxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			
3. Copper wire and cable covered and insulated[3]			
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Signed: ——, ——

[fol. 5967] United States Department of Justice

Schedule II

Gross Additions [1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Name of Utility

Address of Utility

Type of Underground Cable	Answer in Thousands of Feet [2] 1950	1955	1959
	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
A. Transmission cable...............	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable...............	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			

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[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.'

Signed: ——, ——

[fol. 5968] United States Department of Justice

Schedule III

Name of Utility

Address of Utility

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Signed: ——, ——

[fol. 5969] United States Department of Justice

Schedule IV

Name of Utility

Address of Utility

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Signed: ——, ——

[fol. 5970] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 468A

Schedules Prepared by Electric Utilities Showing Use of Copper and Aluminum Conductor

Regions I, II & III

[fol. 5971] Utilities

Region: I Northeastern

State	Name
Connecticut	Connecticut Light & Power Co.
Delaware	Delaware Power & Light Co.
District of Columbia	Potomac Electric Power Co.
Maine	Central Maine Power Co.
Maryland	Baltimore Gas & Electric Co.
Maryland	Choptank Electric Coop., Inc.
Massachusetts	Boston Edison Co.
New Hampshire	Public Service Co. of New Hampshire
New Jersey	Public Service Electric & Gas Co.
New York	Jamestown Municipal Electric Co.
New York	Long Island Lighting Co.
New York	Consolidated Edison Co. of New York
New York	Niagara Mohawk Power Co.
Pennsylvania	Pennsylvania Power & Light Co.
Pennsylvania	West Penn Power Co.
Pennsylvania	Philadelphia Electric Co.
Pennsylvania	Duquesne Light Co.
Rhode Island	The Narragansett Electric Co.
Vermont	Central Vermont Public Service Corp.
Virginia	Southside Electric Coop.
Virginia	Virginia Electric & Power Co.
West Virginia	Appalachin Power Co.

[fol. 5972] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Connecticut Light & Power Company
P. O. Box 2010, Hartford 1, Conn.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	206	1
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	147
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3,511	3,888	2,875
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	1,692	2,091
3. Copper wire and cable covered and insulated[3]	4,722	2,724	1,200
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	3,384	1,679

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Walter W. Foreman
Vice President
October 28, 1960

[fol. 5973] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Connecticut Light & Power Company
P. O. Box 2010, Hartford 1, Conn.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	89	253	471
2. Aluminum & Aluminum Alloy	—	24	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Walter W. Foreman
Vice President
October 28, 1960

[fol. 5974] United States Department of Justice

Schedule III

The Connecticut Light & Power Company
P. O. Box 2010, Hartford 1, Conn.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe th changes indicating when they will occur.

Over an extended period, proportion of aluminum to copper expected to increase since aluminum cable is primary standard for overhead construction. In distribution category, the ratio may be static in 1960 and 1961 as Company uses existing stocks of copper cable.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum restricted in areas adjacent to salt water because of connector corrosion problems.

Walter W. Foreman
Vice President
October 28, 1960

[fol. 5975] United States Department of Justice

Schedule IV

The Connecticut Light & Power Company
P. O. Box 2010, Hartford 1, Conn.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum Conductor Underground Cable is not in Company standards.
Restricted because of Space limitations (duct)
Thermal Expansion properties
Insulation economics.
Connector problems

Walter W. Foreman
Vice President
October 28, 1960

[fol. 5976] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Delaware Power & Light Company
660 Market St., Wilmington 99, Del.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	365.971	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	849.566	4.085
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	604.155	105.850	38.441
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4.680	795.248	686.241
3. Copper wire and cable covered and insulated[3]	1,376.725	391.769	184.516
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	1,530.416	1,272.111

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. P. Hyer
Chairman of The Board & Chief,
Executive Officer
October 31, 1960

[fol. 5977] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Delaware Power & Light Company
600 Market St., Wilmington 99, Del.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	303.588	32.781	87.550
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. P. Hyer
Chairman of The Board & Chief,
Executive Officer
October 31, 1960

[fol. 5978] United States Department of Justice

Schedule III

Delaware Power & Light Company
600 Market St., Wilmington 99, Del.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Estimated to continue in same proportion as in 1959.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restriction.

F. P. Hyer
Chairman of The Board & Chief,
Executive Officer
October 31, 1960

[fol. 5979] United States Department of Justice

Schedule IV

Delaware Power & Light Company
600 Market St., Wilmington 99, Del.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Do not plan to use aluminum for underground cables.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Space limitation in existing ducts prevents use of aluminum.

F. P. Hyer
Chairman of The Board & Chief,
Executive Officer
October 31, 1960

[fol. 5980] Potomac Electric Power Company
929 E. Street, Northwest
Washington 4, D. C.

December 22, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

At the telephonic request of Mr. Samuel Karp, Attorney, we are resubmitting the set of schedules relating to the use of aluminum and copper conductors in order to clarify and amplify the statements as originally submitted.

Schedules I & II have not been changed from the original. Schedule III has been amplified to show the estimated change in the proportion of aluminum to copper in 1960 over 1959 occasioned by the present practice of using aluminum conductors for overhead lines, except for distribution primaries, which was established late in 1959. Schedule IV has been restated to cover underground cables only.

Very truly yours, George Bisset, Senior Vice President.

[fol. 5981] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Potomac Electric Power Company
929 E St., N. W., Wash. 4, D. C.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	87	—	1,651
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,939	2,317	3,570
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	902
3. Copper wire and cable covered and insulated[3]	3,677	3,785	2,963
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	120	2

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

George Bisset
Senior Vice President
December 22, 1960

[fol. 5982] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Potomac Electric Power Company
929 E St., N. W., Wash. 4, D. C.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	373	134	177
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,373	1,012	1,695
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

George Bisset
Senior Vice President
December 22, 1960

[fol. 5983] United States Department of Justice

Schedule III

Potomac Electric Power Company
929 E St., N. W., Wash. 4, D. C.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Our present practice (established late in 1959) of using aluminum Conductors for overhead lines, except for distribution primaries for which copper is standard, will increase the proportion of aluminum to copper in 1960 over 1959. If we assume the quantities of Conductors installed in 1960 to be the same as in 1959 (no 1960 figures being available at this time), the following percentage usage should result.

	1959 Actual	1960 Estimated
Schedule B1 Bare Copper	79.8%	35.9%
B2 Bare Aluminum	20.2%	64.1%
B3 Ins. Copper	99.9%	4.3%
B4 Ins. Aluminum	0.1%	95.7%

We have no plans or schedule for changing this practice at the present time.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum conductor is not restricted because of corrosion. Copper is preferred for distribution primaries because it is easier to install, maintain and rearrange, also it has greater salvage value. We have no highly corrosive atmosphere on this system.

George Bisset
Senior Vice President
December 22, 1960

[fol. 5984] United States Department of Justice

Schedule IV

Potomac Electric Power Company
929 E St., N. W., Wash. 4, D. C.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Our present practice is to use copper conductors for all underground lines. We have no plans or schedule for changing this practice, at this time.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not use any aluminum conductors for underground cable because we have not found any price advantage on an installed basis. The use of aluminum for either conductor or sheath is not standard with the cable manufacturers. There have been experimental installations, but standard installation methods have not been developed.

George Bissct
Senior Vice President
December 22, 1960

[fol. 5985] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959
Baltimore Gas and Electric Company

Lexington and Liberty Streets,
Baltimore 3, Maryland

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	307	2	6
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	181	—	28
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,269	856	285
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	741	2,451	2,347
3. Copper wire and cable covered and insulated[3]	1,504	6,819	3,308
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	2,238	4,808
Copper weld			
Transmission	177	3	—
Distribution	—	—	101

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. E. Smith
Secretary
October 31, 1960

[fol. 5986] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959
Baltimore Gas and Electric Company

Lexington and Liberty Streets,
Baltimore 3, Maryland

Type of Underground Cable & Wire	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	2	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	2,011	1,311	1,072
2. Aluminum & Alummum Alloy			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. E. Smith
Secretary
October 31, 1960

[fol. 5987] United States Department of Justice

Schedule III

Baltimore Gas and Electric Company
Lexington and Liberty Streets,
Baltimore 3, Maryland

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We expect the proportion of aluminum to copper used in both transmission and distribution lines to increase in 1960 and in subsequent years.

New extensions are normally made with aluminum conductors. Lines that must be reconductored because of load growth are normally reconductored with aluminum. The old copper wires are scrapped if they are small in size or are damaged.

The substitution of aluminum conductors for copper is a continuing process and will therefore not occur in any particular future year.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum conductors is somewhat limited in industrial areas due to chemical contamination. Copper conductors are normally used for 4 kv and higher voltage lines. Aluminum conductors are used for service drops and other secondary voltage lines. Aluminum conductors are normally covered.

This limitation was imposed to prevent possible corrosion and weakening of aluminum conductors. Continuing test work and experience indicate that our fears

of corrosion of aluminum conductors in these areas may be unfounded. However, no change in policy has yet been made since salvaged copper wire is generally available.

O. E. Smith
Secretary
October 31, 1960

[fol. 5988] United States Department of Justice

Schedule IV

Baltimore Gas and Electric Company
Lexington and Liberty Streets,
Baltimore 3, Maryland

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change contemplated.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Economic consideration only.

O. E. Smith
Secretary
October 31, 1960

[fol. 5989] Choptank Electric Cooperative, Inc.
Denton, Maryland

October 20, 1960

U. S. Department of Justice
Washington, D. C.
Attention: Mr. Robert A. Bicks

Asst. Attorney General
Antitrust Division

Gentlemen:

Referring to your questionnaire concerning the relative use of aluminum and copper conductor on our system for new construction and replacements:

We are attaching hereto the questionnaire that has been filled in as much as we are able to inform you concerning the use of aluminum and copper on our system. We hope that you will find the information useful.

Very truly yours, Choptank Electric Cooperative, Inc., F. E. Yeoman, Manager.

FEY/a
Enc.

[fol. 5990] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Choptank Electric Cooperative, Inc.
Denton, Maryland

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	24,535	581	696
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	632	38
3. Copper wire and cable covered and insulated [3]	331	212	59
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	0	32	186

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. E. Yeoman
Manager
October 19, 1960

[fol. 5991] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Choptank Electric Cooperative, Inc.
Denton, Maryland**

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. E. Yeoman
Manager
October 19, 1960

[fol. 5992] United States Department of Justice

Schedule III

Choptank Electric Cooperative, Inc.,
Denton, Maryland

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

A.

Bare Wire

We expect an increase in the proportion of aluminum to copper wire over that of 1959. Most lines that are rebuilt due to increased load are built from aluminum. This is not reflected in the 1959 figure since no lines were rebuilt in that year. The 1955 figure is a truer picture of the proportions of aluminum to copper expected in the future.

Covered Wire

We expect the proportion of aluminum to copper wire to remain the same as 1959.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

B.

We restrict the use of aluminum for lines within two miles of the ocean because of corrosion of connections. No change is expected in this restriction.

F. E. Yeoman
Manager
October 19, 1960

[fol. 5993] United States Department of Justice

Schedule IV

Choptank Electric Cooperative, Inc.,
Denton, Maryland

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

F. E. Yeoman
Manager
October 19, 1960

[fol. 5994] Central Maine Power Company

General Office - 9 Green Street - Augusta, Maine

October 27, 1960

Robert A. Bicks, Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Ref: RAB:CLW
60-0-37-256

Dear Mr. Bicks:

We are enclosing the information which you requested on October 11, 1960 as to our use of electrical conductor in 1950, 1955 and 1959 and planned use in the future.

Very truly yours, W. H. Kimball, Comptroller.

[fol. 5995] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Central Maine Power Company
Augusta, Maine

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	35	273	186
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	873	871	522
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	5,000 Est.	2,109	280
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	19	1,128	1,724
3. Copper wire and cable covered and insulated[3]	2,500 Est.	4,227	360
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	29	455	4,126

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. H. Kimball
Comptroller
October 27, 1960

[fol. 5996] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Central Maine Power Company
Augusta, Maine

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	69	162	48
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. H. Kimball
Comptroller
October 27, 1960

[fol. 5997] United States Department of Justice

Schedule III

Central Maine Power Company
Augusta, Maine

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We expect the increasing use of aluminum to continue as long as the costs are lower than copper.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

W. H. Kimball
Comptroller
October 27, 1960

[fol. 5998] United States Department of Justice

Schedule IV

Central Maine Power Company
Augusta, Maine

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No changes contemplated.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Not used because of space limitations and because of limited experience in the industry with terminations, connections, etc.

W. H. Kimball
Comptroller
October 27, 1960

[fol. 5999] Boston Edison Company
Executive Offices
182 Tremont Street
Boston 12, Massachusetts

December 12, 1960

United States Department of Justice
Washington, D.C.
Atten: Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division

Dear Mr. Bicks:

In accordance with our telephone conversation with Mr. Karp of December 5, 1960 we are enclosing herewith by AIR-MAIL a revised set of schedule forms.

Please note the average 50 foot length of service drops have been broken down according to actual number of strands used in each service rather than using an average of three strands. This changes the estimate slightly from what was quoted by telephone December 5th.

Bare and covered wire as originally reported in schedule 1B, have been revised to include service drops.

We regret the inconvenience this has caused you.

Sincerely yours, Ralph M. Kelmon, Assistant Treasurer.

RMK/NCE/mal
enclosure:

[fol. 6000] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3,256	3,737	2,019
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5	240	1,274
3. Copper wire and cable covered and insulated[3]	499	1,285	389
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	None	975

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Ralph M. Kelmon
Assistant Treasurer
December 12, 1960

[fol. 6001] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	12	143	106
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,676	2,148	2,158
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Ralph M. Kelmon
Assistant Treasurer
December 12, 1960

[fol. 6002] United States Department of Justice

Schedule III

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

About the same through 1961. Beyond that, it is dependent upon costs.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Use of Aluminum versus Copper for Service Drops

1. Approximately 90% of wire used for service drops is aluminum. For the most part, three strand, number four wire is used for residential not-withstanding it is only 80% as good as copper in conductivity.

2. Three strand, number 1/0 or 3/500 copper wire which is larger wire is primarily used for commercial service drops because it is a better conductor for load requirements.

Ralph M. Kelmon
Assistant Treasurer
December 12, 1960

[fol. 6003] United States Department of Justice

Schedule IV

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Ralph M. Kelmon
Assistant Treasurer
December 12, 1960

[fol. 6004] Boston Edison Company
Executive Offices
182 Tremont Street
Boston 12, Massachusetts

November 22, 1960

United States Department of Justice
Washington, D. C.
Atten: Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division

Dear Mr. Bicks:

Your letter of October 11, 1960, (RAB:CLW 60-0-37-256) addressed to our late President, Mr. T. G. Dignan, has been referred to me for reply.

I am forwarding herewith by AIR MAIL the schedules furnishing the information requested.

I regret the delay in preparation of these schedules.

Very truly yours, Albert C. McMenimen, Financial Vice Pres. & Treas.

ACM/NCE/mm

[fol. 6005] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

Type of Overhead Line	Answer in Thousands of Feet [2] (A) 1950	(B) 1955	(C) 1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,844	3,737	2,019
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5	240	820
3. Copper wire and cable covered and insulated [3]	17	20	230
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

(A) Does not include the length of 6,038 O.H. Services.
(B) Does not include the length of 8,648 O.H. Services.
(C) Does not include the length of 10,823 O.H. Services.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Albert C. McMenimen
Financial Vice Pres. & Treas.
November 22, 1960

[fol. 6006] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

Type of Underground Cable	Answer in Thousands of Feet[2] (A) 1950	(B) 1955	(C) 1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	12	143	106
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,354	1,816	2,007
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

(A) Does not include the length of 2,147 U.G. Services.
(B) Does not include the length of 2,265 U.G. Services.
(C) Does not include the length of 1,034 U.G. Services.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Albert C. McMenimen
Financial Vice Pres. & Treas.
November 22, 1960

[fol. 6007] United States Department of Justice

Schedule III

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

About the same.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Albert C. McMenimen
Financial Vice Pres. & Treas.
November 22, 1960

[fol. 6008] United States Department of Justice

Schedule IV

Boston Edison Company
182 Tremont Street, Boston 12, Massachusetts

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Albert C. McMenimen
Financial Vice Pres. & Treas.
November 22, 1960

[fol. 6009] Public Service Company of
New Hampshire
Executive Offices
Manchester, N. H.

October 25, 1960

United States Department of Justice
Washington, D. C.
Re: RAB:CLW
60-0-37-256
Att: Robert A. Bicks, Ass't Attorney General

Gentlemen:

We have every desire to cooperate with the Department of Justice in supplying information as to the use by our Company of aluminum and copper conductor as requested in your letter of October 11, 1960.

However, the amount of work involved in collecting the information is so great that we can supply estimates only for the year 1955 and 1959, but have no readily available source of information for the year 1950.

You will find our estimates set forth on the sheets enclosed.

Yours very truly, A. R. Schiller, President.

ARS:L
Enc.

[fol. 6010] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Co. of N. H.
1087 Elm Street, Manchester, N. H.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare		21,918	725
2. Aluminum and aluminum alloy wire and cable-bare & ACSR		436,454	463,290
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare		3,328	488
2. Aluminum and aluminum alloy wire and cable-bare & ACSR		165,229	2,335,921
3. Copper wire and cable covered and insulated[3]		1,267,898	45,060
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]		2,592,971	3,478,840

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Public Service Co. of N. H.
October 25, 1960

[fol. 6011] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Co. of N. H.
1087 Elm Street, Manchester, N. H.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper		None	None
2. Aluminum & Aluminum Alloy		None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper		85,173	26,212
2. Aluminum & Aluminum Alloy		None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Public Service Co. of N. H.
October 25, 1960

[fol. 6012] United States Department of Justice

Schedule III

Public Service Co. of N. H.
1087 Elm Street
Manchester, N. H.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No anticipated change.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions imposed.

Public Service Co. of N. H.
October 25, 1960

[fol. 6013] United States Department of Justice

Schedule IV

Public Service Co. of N. H.
1087 Elm Street
Manchester, N. H.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No anticipated change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum conductor has never been used in present underground system. Size of existing ducts and space limitations could be considered as primary reason.

Public Service Co. of N. H.
October 25, 1960

[fol. 6014] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Electric and Gas Company
20 Park Place, Newark 1, New Jersey

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	548.
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	92.	1,152.	1,208.
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	260.	623.	625.
3. Copper wire and cable covered and insulated[3]	5,515.	11,366.	3,654.
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	14,193.	19,522.

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Quantities based on purchase orders placed for each size of each construction during the indicated years adjusted for estimated quantities used for maintenance.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

John E. Hunt
Manager of Purchases
November 2, 1960

[fol. 6015] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Electric and Gas Company
80 Park Place, Newark 1, New Jersey

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,365.	1,932.	1,869.
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

Quantities based on purchase orders placed for each size of each construction during the indicated years adjusted for estimated quantities used for maintenance.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

John E. Hunt
Manager of Purchases
November 2, 1960

[fol. 6016] United States Department of Justice

Schedule III

Public Service Electric and Gas Company
80 Park Place
Newark 1, New Jersey

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change in the present proportionate use of aluminum and copper is foreseen. If the two metals change radically in relative price, the use will be re-evaluated.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

(Signature illegible)
General Supt. of Distribution
November 2, 1960

[fol. 6017] United States Department of Justice

Schedule IV

Public Service Electric and Gas Company
80 Park Place
Newark 1, New Jersey

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Same answer as Schedule III A.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Insulated aluminum conductors are acceptable underground only when provided with metallic sheath. Such cables may at certain places be limited by available duct size. This limitation, while completely general, becomes of practical nature on rare occasions.

(Signature illegible)
General Supt. of Distribution
November 2, 1960

[fol. 6018] Board of Public Utilities
City of
Jamestown, New York
Electric Division

October 20, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

Reference: RAB:CLW
60-0-37-256

Attached are Schedules I through IV with the applicable blanks filled in. These schedules were transmitted with your letter of October 11, 1960.

Very truly yours, Board of Public Utilities, Merle W. Smedberg, Superintendent.

Enclosures

[fol. 6019] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959 [2]

Jamestown Municipal Electric System
200 East Third Street, Jamestown, New York

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
3. Copper wire and cable covered and insulated [3]	292	274	291
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Merle W. Smedberg
Superintendent of Public Utilities
October 20, 1960

[fol. 6020] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Jamestown Municipal Electric System
200 East Third Street, Jamestown, New York

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	.35	1	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	6	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Merle W. Smedberg
Superintendent of Public Utilities
October 20, 1960

[fol. 6021] United States Department of Justice

Schedule III

Jamestown Municipal Electric System
200 East Third Street
Jamestown, New York

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We have started to use aluminum and aluminum alloy wire covered and insulated in the form of triplex conductor for service drops. It is expected that more of this type of conductor will be used in the future. We are also checking the economics of using covered aluminum alloy wire on distribution lines.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

There is no area in our service area in which we would restrict the use of aluminum conductor.

Merle W. Smedberg
Superintendent of Public Utilities
October 20, 1960

[fol. 6022] United States Department of Justice

Schedule IV

Jamestown Municipal Electric System
200 East Third Street
Jamestown, New York

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Inasmuch as our underground cable installations will be replacements during this year and next year, we will continue the use of copper type of cable for replacements.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Merle W. Smedberg
Superintendent of Public Utilities
October 20, 1960

[fol. 6023] Long Island Lighting Company
Executive Offices
250 Old Country Road
Mineola, N. Y.

November 3, 1960

Robert A. Bicks, Esq.
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.
Your Reference No. 60-0-37-256

Dear Sir:

Enclosed herewith are the schedules which were furnished with your letter dated October 11, 1960.

The information requested in the schedules has been supplied with the exception of data concerning gross additions of electric conductors in the year 1950. Our records for that period, and for several subsequent years, are not in a form that permits this information to be extracted without the expenditure of a substantial amount of time and consequent disruption of other activities. We know, however, that aluminum conductors were generally introduced into the system after 1950. If the information is deemed essential for your purposes, we will undertake to supply it but it would take two to three weeks to make it available.

Very truly yours, Charles R. Pierce.

CRP:CBF
encls.

[fol. 6024] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Long Island Lighting Company
250 Old Country Road, Mineola, New York

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	*	1,131	437
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	*	228	420
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	*	4,677	1,797
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	*	1,105	938
3. Copper wire and cable covered and insulated[3]	*	3,486	1,626
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	*	2,032	1,504

* Information not readily available from Company Records.

---

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note: For cable assemblies where the neutral conductor is bare and the power conductors are insulated the single conductor footage for the bare neutral was included under B-1 or B-2 and the footage for the insulated conductors was included under B-3 or B-4.

Line contained in our form and therefore not inserted by company to note any delineation of its note. Ellery R. Fosdick.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Charles E. Elbert,
Secretary
November 3, 1960

[fol. 6025] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Long Island Lighting Company
250 Old Country Road, Mineola, New York

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	*	219	7
2. Aluminum & Aluminum Alloy	*	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	*	507	448
2. Aluminum & Aluminum Alloy	*	464	7

* Information not readily available from Company Records.

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Charles E. Elbert,
Secretary
November 3, 1960

[fol. 6026] United States Department of Justice

Schedule III

Long Island Lighting Company
250 Old Country Road
Mineola, New York

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

The proportion of aluminum to copper usage is expected to remain the same in 1960. Commencing in 1961 the proportion of aluminum to copper usage is expected to increase because of the adoption of aluminum for use as a primary conductor on lines operated at 13 KV.

A further slight increase in aluminum usage is expected for future years if experience permits an enlargement of the area now zoned for aluminum use. The predicted use of aluminum as stated herein assumes the continuance of a price differential in its favor comparable to that which now exists.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum is restricted to a zoned inland area (approximately 80% of the service territory) because of severe corrosion along the shore caused by salt fog and sand blast on the unprotected conductors and connectors. The boundaries in the aluminum zone were conservatively selected so that with favorable operating experience they could be extended to include a larger area.

The unavailability in the past of suitable aluminum connectors for hot stick operation at 13 KV delayed the application of aluminum as a 13KV primary conductor. Recent improvements in connectors now make this application acceptable.

Charles E. Elbert,
Secretary
November 3, 1960

[fol. 6027] United States Department of Justice

Schedule IV

Long Island Lighting Company
250 Old Country Road
Mineola, New York

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

The use of aluminum for underground cables is expected to be discontinued in 1960 and future years. It is not planned to utilize aluminum for underground cables because test installations indicated this type of cable to be unsatisfactory for our use.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum underground cable was used only for direct buried street lighting. Experience caused us to change over to copper cable for this use because of difficulty with splicing, connections and extent of conductor damage when faults occurred.

Charles E. Elbert,
Secretary
November 3, 1960

[fol. 6028] Consolidated Edison Company of
New York, Inc.
4 Irving Place
New York 3, N. Y.

October 31, 1960
Re RAB:CLW
60-0-37-256

Hon. Robert A. Bicks
Assistant Attorney General
Anti-Trust Division
Department of Justice
Washington, D. C.

Dear Sir:

In accordance with your letter of October 11-1960, sent to this Company, seeking information as to the relative use of aluminum and copper conductors for new construction and for replacement, we are returning to you the schedules with the information you requested.

We trust that this information is satisfactory.

Very truly yours, C. T. Hatcher, Division Engineer.

Enc
CTH-JC

[fol. 6029] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959[2]

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York 3, N. Y.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950 Estimated	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	2	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	6	0
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	18	198	321
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	46
3. Copper wire and cable covered and insulated[3]	5,454	5,817	3,671
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	5,317	6,047

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. T. Hatcher
Division Engineer
October 31, 1960

[fol. 6030] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York 3, N. Y.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950 Estimated	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	67	795
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	11,731	12,294	15,349
2. Aluminum & Aluminum Alloy	0	0	59

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. T. Hatcher
Division Engineer
October 31, 1960

[fol. 6031] United States Department of Justice

Schedule III

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York 3, N. Y.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

There has been an increase in the proportion of aluminum conductor to copper conductor used in the last several years and we expect this trend to continne slightly in 1960 and subsequent years.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Our principal use of aluminum is for service drops. The need for line wire on our distribution system is primarily for replacement, rearrangement and extension of our existing copper system. We do not use aluminum conductors for line wire because of additional difficulties in splicing and dead-ending, particularly under emergency conditions.

C. T. Hatcher
Division Engineer
October 31, 1960

[fol. 6032] United States Department of Justice

Schedule IV

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York 3, N. Y.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We do not use aluminum conductor at the present time and do not expect any increase in use in 1960 and subsequent years unless there is a significant change in the economic picture.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

It is uneconomical to use aluminum conductors on our system at the present time due to increase in duct and splicing box space requirements and the additional difficulties in making interconnections with our existing copper system..

C. T. Hatcher
Division Engineer
October 31, 1960

[fol. 6033] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Niagara Mohawk Power Corporation
300 Erie Boulevard West, Syracuse 2, N. Y.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,603,000	148,000	443,000
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	435,000	1,225,000	3,046,000
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3,285,000	667,000	232,000
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2,795,000	5,379,000	9,805,000
3. Copper wire and cable covered and insulated[3]	16,878,000	6,446,000	2,866,000
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	278,000	10,841,000	12,783,000

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

(Signature illegible)
Vice President
October 31, 1960

[fol. 6034] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Niagara Mohawk Power Corporation
300 Erie Boulevard West, Syracuse 2, N. Y.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	122,000	301,000	312,000
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	912,000	903,000	1,007,000
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

(Signature illegible)
Vice President
October 31, 1960

[fol. 6035] United States Department of Justice

Schedule III

Niagara Mohawk Power Corporation
300 Erie Boulevard West, Syracuse 2, N. Y.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

(Signature illegible)
Vice President
October 31, 1960

[fol. 6036] United States Department of Justice

Schedule IV

Niagara Mohawk Power Corporation
300 Erie Boulevard West, Syracuse 2, N. Y.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

(Signature illegible)
Vice President
October 31, 1960.

[fol. 6037] Pennsylvania Power & Light Company
Ninth and Hamilton Streets, Allentown, Pa.

June 16, 1961

Mr. Lee Loevinger
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. W. Wallace Kirkpatrick
First Assistant
Ref: LL:WWK:CLW
60-0-37-256

Dear Sir:

In reference to your telephone request of June 7, 1961, and your letter dated June 9, 1961, attached are the completed Schedules I & II on which we have included the 1959 figures along with the figures previously reported for 1950 & 1955. Please note that on Schedule II—the figure shown for B-1 for 1955 has been changed to 33 from 37—A typographical error was made on the first report. Schedules III & IV remain the same as reported on October 25, 1960, and are therefore not attached.

Also supplementing our letter to Mr. Robert A. Bicks dated December 14, 1960, regarding the estimated amount of wire used for service drops, the estimate for 1959 is as follows:

	Thousands of Feet		
	Copper	Aluminum	Total
Year 1959	1500	7300	8800

This estimated footage is in addition to the 1959 figure given on the attached Schedule I-B. The approximate ratio of copper wire to aluminum wire used for service drops in 1959 is 17% copper and 83% aluminum.

Very truly yours, P. W. Siekman, Vice President, General Services.

Attachs.

[fol. 6038] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pennsylvania Power & Light Company
9th & Hamilton Streets, Allentown, Pa.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	50	204	12
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5	405	71
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)**	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,766	1,566	842
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	145	4,688	5,954
3. Copper wire and cable covered and insulated[3]	3,822	4,292	449
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	74	17

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

** Service drops are not included since our records do not show kinds of wire used.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is

P. W. Siekman
Vice President, General Services
June 16, 1961

[fol. 6039] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pennsylvania Power & Light Company
9th & Hamilton Streets, Allentown, Pa.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	11	33	34
2. Aluminum & Aluminum Alloy	—	.1	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

P. W. Siekman
Vice President, General Services
June 16, 1961

[fol. 6040] Pennsylvania Power & Light Company
Ninth and Hamilton Streets, Allentown, Pa.

December 14, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
U. S. Department of Justice
Washington, D. C.

Attention: Mr. Lellery Fosdick
Ref: RAB:CLW
60-0-37-256

Dear Sir:

This will confirm my telephone conversation of today with Messrs. Samuel Karp and Lellery Fosdick, regarding the estimated amount of wire used for service drops during the years 1950, 1955 and 1958.

	Thousands of Feet		
	Copper	Aluminum	Total
1950	7300	0	7300
1955	3500	5200	8700
1958	1800	7300	9100

These estimates are based on stores issues of the size and type of wire normally used for service drops, and in our opinion are fairly accurate estimates.

In 1950 and prior thereto, nearly all service drops were 100% copper. Sometime after 1950, we started using some aluminum wire for service drops. Gradually its use increased so that in 1958, the approximate ratio was 80% aluminum and 20% copper. We expect this ratio to continue in the future, since our specifications require the use of covered aluminum wire for most new residential construction, and covered copper wire for the heavier type service drops and some connections to old copper distribution lines.

The above estimated footage of wire is in addition to those figures given on Schedule I-B, attached to our letter of November 9, 1960.

Very truly yours, P. W. Siekman, Vice President, General Services.

[fol. 6041] Pennsylvania Power & Light Company
Ninth and Hamilton Streets, Allentown, Pa.

November 9, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
U. S. Department of Justice
Washington, D. C.

Dear Mr. Bicks:

Attached are the completed schedules I to IV, inclusive, which were returned to us for correction of schedules I & II, on which we inadvertently reported data in feet instead of in thousands of feet.

On October 28, 1960, your Mr. Samuel Karp phoned me and requested information on the following:

1. Our general policy on the use of wire for distribution lines.
2. The reason for the decrease in the use of wire in 1958 as shown on Schedule I.
3. The ratio of copper wire to aluminum wire used for service drops.

On November 2, 1960, I phoned Mr. Karp and gave him the information requested. Attached to Schedule I is a supplemental sheet confirming the information which was passed on to Mr. Karp.

Very truly yours, P. W. Siekman, Vice President, General Services.

Attachs.

[fol. 6042] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pennsylvania Power & Light Company
Ninth & Hamilton Streets, Allentown, Pennsylvania

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1958*
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	50	204	51
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5	405	1,209
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)**	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,766	1,566	240
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	145	4,688	5,289
3. Copper wire and cable covered and insulated[3]	3,822	4,292	1,170
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	74	2

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

* The data for 1959 will not be available for about eight months.

** Service drops are not included since our records do not show kinds of wire used.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

P. W. Siekman
Vice President, General Services
October 25, 1960

[fol. 6043] Explanatory Notes Regarding Schedule I
As Requested by Mr. Karp on 10/28/60

1. *General Policy on Use of Wire for Distribution Lines*

In 1950 and prior thereto, our Company used copper wire for the majority of distribution lines and services constructed. Sometime after 1950, we started to test the use of aluminum wire. Within a few years it had proved worthwhile so that by 1956 the majority of distribution lines constructed were of aluminum. We switched from copper to aluminum because of economic considerations, inasmuch as aluminum wire is substantially cheaper than equivalent copper wire. Some copper wire is still being used, especially for short extensions to existing copper lines where mechanical reasons indicate that matching is desirable.

2. *Reason for the Decrease in the Use of Wire in 1958*

It has been noted that the total wire (copper and aluminum) used for distribution was less in 1958 than in 1955. The reason for the decrease is that less new line construction and fewer line conversions (converting a line to higher capacity) took place in 1958 than in 1955. It has also been noted that we used less covered aluminum wire in 1958 than we did in 1955 (item B-4 on Schedule I). The reason is that during 1955 we had discontinued the use of single conductor covered aluminum wire for overhead primary distribution lines and had substituted bare wire, except in special cases in trees and near other objects where close clearances exist.

3. *Ratio of Copper Wire to Aluminum Wire used for Service Drops*

Our records do not show this information. However, it is estimated that in 1950 nearly all service drops were copper wire. In 1955, approximately 40% were copper and 60% aluminum wire. In 1958, approxi-

mately 20% were copper and 80% aluminum. We expect the 1958 ratio to continue as our specifications require the use of covered aluminum wire for most new residential construction and covered copper wire for the heavier type service drops.

[fol. 6044] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pennsylvania Power & Light Company
Ninth & Hamilton Streets, Allentown, Pennsylvania

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1958*
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	11	37	20
2. Aluminum & Aluminum Alloy	—	.1	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

* The data for 1959 will not be available for about eight months.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

P. W. Siekman
Vice President, General Services
October 25, 1960

[fol. 6045] United States Department of Justice

Schedule III

Pennsylvania Power & Light Company
Ninth & Hamilton Streets
Allentown, Pennsylvania

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Transmission Lines

We do not now anticipate any change in the proportion of aluminum to copper which will be used in 1960 or in subsequent years.

Distribution Lines

It is expected that the proportion of aluminum to copper will increase gradually.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions are placed on the use of aluminum conductors for overhead transmission and distribution lines.

P. W. Siekman
Vice President, General Services
October 25, 1960

[fol. 6046] United States Department of Justice

Schedule IV

Pennsylvania Power & Light Company
Ninth & Hamilton Streets
Allentown, Pennsylvania

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Transmission Cable

We do not now anticipate any change in the proportion of aluminum to copper which will be used in 1960 or in subsequent years.

Distribution Cable

It is not expected that there will be any substantial change in the proportion of aluminum to copper used in 1960 or in subsequent years.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions are placed on the use of aluminum conductor for underground cables.

P. W. Siekman
Vice President, General Services
October 25, 1960

[fol. 6047] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

West Penn Power Co.
Cabin Hill, Greensburg, Pa.

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1434	18	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1323	84	445
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	6641	1110	482
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4231	2962	4601
3. Copper wire and cable covered and insulated [3]	6863	1885	646
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	2	3037	3700

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

J. O. Chambers
Vice President-Engineering
October 20, 1960.

[fol. 6048] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

West Penn Power Co.
Cabin Hill, Greensburg, Pa.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	2	—	1
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

J. O. Chambers
Vice President Engineering
October 20, 1960.

[fol. 6049] **United States Department of Justice**

Schedule III

West Penn Power Co.
Cabin Hill, Greensburg, Pa.

A. **State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.**

Overhead Conductor Trend

If the present price relationship of copper and aluminum continues, the use of copper will be reduced to about 5% of the total use by 1962.

B. **State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.**

Limited Use of Aluminum Due to Corrosion

No restriction except for a few isolated areas around coke ovens and gob piles.

J. O. Chambers
Vice President-Engineering
October 20, 1960.

[fol. 6050] United States Department of Justice

Schedule IV

West Penn Power Co.
Cabin Hill, Greensburg, Pa.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Underground Cables Trend

There is no change anticipated to the use of aluminum instead of copper in underground cables at the present time.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Limited Use of Aluminum Due to Corrosion

No plans are made to use aluminum cables because of experience of corrosion in the past.

J. O. Chambers
Vice President-Engineering
October 20, 1960.

[fol. 6051] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor[2] to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Philadelphia Electric Company
1000 Chestnut Street, Philadelphia 5, Pa.

Type of Overhead Line	Answer in Thousands of Feet[3] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	500	1	5
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2	222	555
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	9,743	2,099	853
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	14,954	15,167
* 3. Copper wire and cable covered and insulated[3]	(Amounts included in B-1, above—See Note)		
* 4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	(Amounts included in B-2, above—See Note)		

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

* Note; Records do not show bare and covered wire separately.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

George T. Logan
Statistician
November 1, 1960

[fol. 6052] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Philadelphia Electric Company
1000 Chestnut Street, Philadelphia 5, Pa.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	609	8	178
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	2,585	2,813	1,397
2. Aluminum & Aluminum Alloy	None	None	118

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

George T. Logan
Statistician
November 1, 1960

[fol. 6053] United States Department of Justice

Schedule III

Philadelphia Electric Company
1000 Chestnut Street
Philadelphia 5, Pa.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change anticipated.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions or limitations.

E. B. Shew
Chief Electrical Engineer
November 1, 1960

[fol. 6054] United States Department of Justice

Schedule IV

Philadelphia Electric Company
1000 Chestnut Street
Philadelphia 5, Pa.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change anticipated.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductor is not limited or restricted except by total in place costs to us.

E. B. Shew
Chief Electrical Engineer
November 1, 1960

[fol. 6055] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Duquesne Light Company
435 Sixth Avenue, Pittsburgh 19, Pa.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	7.0	40.1	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	317.4	0	45.5
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2776.7	2659.8	2139.7
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	12.1	165.5	592.2
3. Copper wire and cable covered and insulated[3]	3113.2	1070.0	1014.9
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	3975.5	3407.0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. H. Hegmann
Controller
October 24, 1960

[fol. 6056] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Duquesne Light Company
435 Sixth Avenue, Pittsburgh 19, Pa.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	163.5	204.1	147.5
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. H. Hegmann
Controller
October 24, 1960

[fol. 6057] United States Department of Justice

Schedule III

Duquesne Light Company
435 Sixth Avenue, Pgh. 19, Pa.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

There will be no appreciable change during 1960.

It is expected in 1961 and subsequent years that the proportion of aluminum to copper used in Schedule I (Overhead Lines) will be increased. The expected changes will be made from copper to aluminum on 4160 volt distribution.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have no restrictions on the use of aluminum conductors for overhead lines.

S. Rosenbach
Electrical Engineer
October 25, 1960

[fol. 6058] United States Department of Justice

Schedule IV

Duquesne Light Company
435 Sixth Avenue, Pgh. 19, Pa.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We do not expect any increase in the proportion of aluminum to copper used in Schedule II (Underground Cables). We presently use no aluminum in this classification.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We restrict the use of aluminum for underground cables because of space limitations, size of existing ducts, corrosion and soil conditions.

S. Rosenbach
Electrical Engineer
October 25, 1960

[fol. 6059] United States Department of Justice

Schedule I

The Narragansett Electric Company
Providence, R. I.

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	90.0	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	229.5	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	*	497.6	517.2
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	*	447.7	582.8
3. Copper wire and cable covered and insulated[3]	*	2,294.1	1,131.1
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	*	404.7	1,151.4

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. G. Queskey
President
November 1, 1960

[fol. 6060] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Narragansett Electric Company
Providence, R. I.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	73.2	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	*	155.7	192.6
2. Aluminum & Aluminum Alloy	None	None	None

* Data not available.

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. G. Queskey
President
November 1, 1960

[fol. 6061] United States Department of Justice

Schedule III

The Narragansett Electric Company
Providence, R. I.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Copper is the preferred material for overhead lines especially in the distribution plant. Use of aluminum is indicated when the cost of that material is more favorable than that of copper, or when the span length between supporting structures is great enough to require conductors having more mechanical strength than copper. We expect that the proportion of aluminum to copper used will be about constant. In 1961, we plan construction of a transmission line paralleling the one built in 1955, and therefore about 230 M. ft. of aluminum alloy wire will be required in that year.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not install aluminum wire within one mile of salt water. Our experience with such installations has been unsatisfactory as to corrosion deterioration.

E. G. Queskey
President
November 1, 1960

[fol. 6061a] United States Department of Justice

Schedule IV

The Narragansett Electric Company
Providence, R. I.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We have no aluminum in the underground plant, and do not expect to use any in the foreseeable future. Should a major expansion be required where direct-buried cable is indicated or new duct lines are to be built, then the choice between aluminum and copper would be based on cost of material for equal carrying capacity.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

It is unfeasible to install aluminum cables in our existing duct lines as the size of ducts would unduly limit the carrying capacity and the manholes would not accommodate the joints and bends.

E. G. Queskey
President
November 1, 1960

[fol. 6062] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Central Vermont Public Service Corporation
77 Grove Street, Rutland, Vermont

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	51.	377.	1.
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	139.	979.	89.
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	744.	206.	72.
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	895.	1514.	1133.
3. Copper wire and cable covered and insulated[3]	601.	331.	175.
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	89.	173.

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold L. Durgin
Executive Vice President
October 26, 1960

[fol. 6063] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Central Vermont Public Service Corporation
77 Grove Street, Rutland, Vermont

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	14.	1.	5.
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold L. Durgin
Executive Vice President
October 26, 1960

[fol. 6064] United States Department of Justice

Schedule III

Central Vermont Public Service Corporation
77 Grove Street
Rutland, Vermont

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No significant changes in proportion expected.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Harold L. Durgin
Executive Vice President
October 26, 1960

[fol. 6065] United States Department of Justice

Schedule IV

Central Vermont Public Service Corporation
77 Grove Street
Rutland, Vermont

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Harold L. Durgin
Executive Vice President
October 26, 1960

[fol. 6066] United States Department of Justice

Schedule I.

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southside Electric Cooperative, Inc.
Crewe, Virginia

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,255.	677.	627.
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			
3. Copper wire and cable covered and insulated[3]	195.	145.	151.
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. S. Hooper, Jr.
Manager
October 25, 1960

[fol. 6067] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southside Electric Cooperative, Inc.
Crewe, Virginia

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. S. Hooper, Jr.
Manager
October 25, 1960

[fol. 6068] United States Department of Justice

Schedule III

Southside Electric Cooperative, Inc.
Crewe, Virginia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Since this System was constructed when aluminum was not available, no aluminum will be used unless some transmission lines have to be built.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No Restrictions.

Southside Electric Cooperative, Inc.

C. S. Hooper, Jr.
Manager
October 25, 1960

[fol. 6069] United States Department of Justice

Schedule IV

Southside Electric Cooperative, Inc.
Crewe, Virginia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Since this System was constructed when aluminum was not available, no aluminum will be used unless some transmission lines have to be built.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No Restrictions.

Southside Electric Cooperative, Inc.

C. S. Hooper, Jr.
Manager
October 25, 1960

[fol. 6070] Virginia Electric and Power Company
Richmond, Virginia

November 21, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Re: RAB:CLW
60-0-37-256

Dear Mr. Bicks:

This will acknowledge your letter of November 18 referring to ours of October 31, 1960 enclosing completed schedules showing the relative use by Virginia Electric and Power Company of aluminum and copper conductor in new construction and replacement.

With regard to Item 5, Schedule I, B reporting service drops in copper and aluminum combined, would advise that our records do not carry a segregation of service drops as between copper and aluminum but we estimate the proportion to be as follows:

	1950	1955	1959
Copper wire—bare and insulated	45%	35%	4%
Aluminum wire—bare and insulated	55%	65%	96%
	100%	100%	100%

The above estimate is based on the ratio of all copper (bare and insulated) and aluminum (bare and insulated) to the total wire used as conductors in distribution lines in each of the periods indicated. We believe this to be a reasonable basis for estimating the amounts of copper service drops and aluminum service drops used by Virginia Electric and Power Company in the periods mentioned.

Very truly yours,

S. E. Ratcliffe
Treasurer

[fol. 6071] Virginia Electric and Power Company
Richmond 9, Virginia

October 31, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Re: RAB:CLW
60-0-37-256

Dear Mr. Bicks:

We hand you herewith forms which we have completed showing the relative use by our Company of aluminum and copper conductor for new construction and for replacement.

Should you have any question concerning the information shown on these schedules, will you please let us know.

Very truly yours,

S. E. Ratcliffe
Treasurer

[fol. 6072] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Virginia Electric and Power Company
7th and Franklin Streets, Richmond, Virginia

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955[4]	1959[4]
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	203	30	—0—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	503	2,922	1,276
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	10,914	7,326	570
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	17,475	18,970	14,148
3. Copper wire and cable covered and insulated[3]	5,083	3,095	131
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	521	1,476	2,044
5. Service drops—copper and aluminum—bare and insulated[5]	11,870	11,109	11,959

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] Distribution conductor is for 12-month period ending July 31.

[5] Company's records reflect quantity of services by number of conductors and are not separated between copper and aluminum or between bare and insulated. Total feet estimated on basis of average length of 100 feet per service conductor.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

S. E. Ratcliffe
Treasurer
October 31, 1960

[fol. 6073] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Virginia Electric and Power Company
7th and Franklin Streets, Richmond, Virginia

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955[3]	1959[3]
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1	—0—	3
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	225	466	118
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

[3] Distribution conductor is for 12-month period ending July 31.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

S. E. Ratcliffe
Treasurer
October 31, 1960

[fol. 6074] United States Department of Justice

Schedule III

Virginia Electric and Power Company
7th and Franklin Streets
Richmond, Virginia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Expect a slight increase due to the expectation that growth in areas where aluminum is used will be greater than in areas where copper is used exclusively.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Corrosion by salt water.

S. E. Ratcliffe
Treasurer
October 31, 1960

[fol. 6075] United States Department of Justice

Schedule IV

Virginia Electric and Power Company
7th and Franklin Streets
Richmond, Virginia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Do not anticipate any change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have not used any aluminum underground cable because we do not believe there is sufficient economic advantage.

S. E. Ratcliffe
Treasurer
October 31, 1960

[fol. 6076] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Appalachian Power Company
40 Franklin Road, Roanoke, Va.

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	41	29	19
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1519	310	1771
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	6000	410	24
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	24000	3700	2409
3. Copper wire and cable covered and insulated [3]	1800	753	75
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	7200	6777	7458

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6077] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Appalachian Power Company
40 Franklin Road, Roanoke, Va.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	8	98	2
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6078] United States Department of Justice

Schedule III

Appalachian Power Company
40 Franklin Road, Roanoke, Va.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Salt water not a problem for this area. ACSR used mostly because of resistance to acid corrosion.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6079] United States Department of Justice

Schedule IV

Appalachian Power Company
40 Franklin Road, Roanoke, Va.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes. Its use is restricted because we are not sure of the long range effect of corrosion of aluminum in contact with moisture where a limited supply of oxygen is available. We are hopeful for an answer to this problem within the next 5 years.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6086] Utilities

Region: II Great Lakes

State	Name
Illinois	Commonwealth Edison Co.
Illinois	Norris Electric Coop.
Indiana	Indiana & Michigan Electric Co.
Indiana	Public Service Co. of Indiana Inc.
Kentucky	Louisville Gas & Electric Co.
Kentucky	Warren Rural Electric Coop. Corp.
Michigan	Board of Water & Electric Light Commissioners—Lansing
Michigan	Detroit Edison Co.
Michigan	Consumers Power Co.
Ohio	Cincinnati Gas & Electric Co.
Ohio	Cleveland Department of Light & Power
Ohio	Cleveland Electric Illuminating Co.
Ohio	Ohio Edison Co.
Ohio	Ohio Power Co.
Wisconsin	Wisconsin Electric Power Co.

[fol. 6081] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Commonwealth Edison Company
Chicago 90, Illinois

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,775	1,207	946
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	5,330	10,789	6,206
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	371	4,295	5,131
3. Copper wire and cable covered and insulated[3]	15,187	12,413	5,849
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	11,192	11,237

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The above quantities of copper and aluminum are approximations obtained from summarized data concerning gross additions to utility plant for the years indicated. We believe, however, that the indicated relationships between copper and aluminum are reasonable.

Tom Bohon
Plant Accountant
October 26, 1960

[fol. 6082] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Commonwealth Edison Company
Chicago 90, Illinois

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	435	433	58
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	680	1,150	722
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The above quantities of copper and aluminum are approximations obtained from summarized data concerning gross additions to utility plant for the years indicated. We believe, however, that the indicated relationships between copper and aluminum are reasonable.

Tom Bohon
Plant Accountant
October 26, 1960

[fol. 6083] United States Department of Justice

Schedule III

Commonwealth Edison Company
Chicago 90, Illinois

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Depending on economic trends, the use of aluminum will probably continue to increase with proportionate decline in the use of copper. The increase in aluminum has been made possible by the improvement and standardization in designs and tools for terminal fittings and connectors. Copper to aluminum overhead conductor use ratio changed from approximately 1:1.44 ratio in 1959 to 1:2 ratio in 1960 and is expected to reach 1:3 ratio in 1961.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum conductor has been restricted in the past due to corrosion preventative construction requirements, non-standardization of terminal fittings and connectors with necessary application tools. With improved alloying of aluminum to higher strengths, the use of copper as a messenger on service entrance cable neutrals will no longer be necessary.

R. B. Gear
Director of Purchases
October 26, 1960

[fol. 6084] United States Department of Justice

Schedule IV

Commonwealth Edison Company
Chicago 90, Illinois

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Currently no increase is expected in use of aluminum for underground cables. A small amount has been used for experiment but its use is limited to direct burial in subdivisions. Until these experiments prove satisfactory, no additional aluminum use is expected.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum is restricted in general use on underground lines by the following:

1. Space limitations in existing duct lines;
2. Costs are higher than copper, paper and lead;
3. Thermal expansion and contraction results in short life of lead sheaths in manholes.

R. B. Gear
Director of Purchases
October 26, 1960

[fol. 6085] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Norris Electric Cooperative
Newton, Illinois

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare			39.248
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			117.744
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	6,314.198	541.970	254.208
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	—
3. Copper wire and cable covered and insulated[3]	537.259	89.418	98.651
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Danny Williams
Manager
October 18, 1960

[fol. 6086] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Norris Electric Cooperative
Newton, Illinois

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	none	none	none
2. Aluminum & Aluminum Alloy	none	none	none
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	none	none	none
2. Aluminum & Aluminum Alloy	none	none	none

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Danny Williams
Manager
October 18, 1960

[fol. 6087] United States Department of Justice

Schedule III

Norris Electric Cooperative
Newton, Illinois

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

Danny Williams
Manager
October 18, 1960

[fol. 6088] United States Department of Justice

Schedule IV

Norris Electric Cooperative
Newton, Illinois

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Have no underground.

Danny Williams
Manager
October 18, 1960

[fol. 6089] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959.

Indiana & Michigan Elec. Co.
2101 Spy Run Ave., Ft. Wayne, Ind.

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	34	70
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2610	1596	830
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	910	210	22
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	3651	1894	2145
3. Copper wire and cable covered and insulated [3]	1200	628	40
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	4800	5648	3971

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6090] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Indiana & Michigan Elec. Co.
2101 Spy Run Ave., Ft. Wayne, Ind.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	7	48	0
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6091] United States Department of Justice

Schedule III

Indiana & Michigan Elec. Co.
2101 Spy Run Ave., Fort Wayne, Ind.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Salt water not a problem in this area. ACSR used mostly because of resistance to acid corrosion.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6092] United States Department of Justice

Schedule IV

Indiana & Michigan Elec. Co.
2101 Spy Run Ave., Fort Wayne, Ind.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes. Its use is restricted because we are not sure of the long range effect of corrosion of aluminum in contact with moisture where a limited supply of oxygen is available. We are hopeful for an answer to this problem within the next 5 years.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6093] United States Department of Justice

Schedule I

Gross-Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of Indiana, Inc.
1000 East Main Street, Plainfield, Indiana

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	691	306	73
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,534	2,811	3,893
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	9,045	6,404	7,059
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	38	138	2,334
3. Copper wire and cable covered and insulated[3]	6,832	7,399	3,377
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	572	2,750

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Earl H. Conway
Vice President & Comptroller
October 28, 1960

[fol. 6094] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Public Service Company of Indiana, Inc.
1000 East Main Street, Plainfield, Indiana**

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	32	30	6
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Earl H. Conway
Vice President & Comptroller
October 28, 1960

[fol. 6095] United States Department of Justice

Schedule III

Public Service Company of Indiana, Inc.
1000 East Main Street, Plainfield, Indiana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Schedule I—A. Tranmission Lines

No significant change contemplated in 1960 or the next five (5) years.

Schedule I—B. Distribution Lines

It is expected that in 1960 there will be an increase in the ratio of Aluminum to Copper in both bare and covered wires. This trend will continue as long as the cost of aluminum, aluminum alloys and ACSR is less per pound than copper.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No such restrictions or limitations.

Edwin W. Gue
Vice President—Engineering
October 28, 1960

[fol. 6096] United States Department of Justice

Schedule IV

Public Service Company of Indiana, Inc.
1000 East Main Street, Plainfield, Indiana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Schedule II—A. & B.

No change contemplated in 1960 or in subsequent years until cost of aluminum cable becomes less than the cost of copper cable having an equivalent current carrying capacity. Resolution of certain technical details will also have a bearing on this matter.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No such restrictions or limitations.

Edwin W. Gue
Vice President—Engineering
October 28, 1960

[fol. 6097] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Louisville Gas and Electric Company
311 W. Chestnut Street, Louisville 2, Ky.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	399	11	50
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	22	—	16
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	574	263	1,447
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	13	—	455
3. Copper wire and cable covered and insulated[3]	1,034	427	348
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	38	18

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. W. Jewell
Vice President in Charge of Operation
October 21, 1960

[fol. 6098] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Louisville Gas and Electric Company
311 W. Chestnut Street, Louisville 2, Ky.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	62	14	58
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

F. W. Jewell
Vice President in Charge of Operation
October 21, 1960

[fol. 6099] United States Department of Justice

Schedule III

Louisville Gas and Electric Company
311 West Chestnut Street, Louisville 2, Ky.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Economy of aluminum and its use for new construction indicates a gradual increase in 1960 and subsequent years in the proportion of aluminum to copper used.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Our use of aluminum is restricted because the major portion of our system is copper and we do not normally mix conductors. We do not normally use aluminum where many connections are needed because of connector difficulties.

F. W. Jewell
Vice President in Charge of Operation
October 21, 1960

[fols. 6100-6101] United States Department of Justice

Schedule IV

Louisville Gas and Electric Company
311 West Chestnut Street, Louisville 2, Ky.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No aluminum being used.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No aluminum being used.

F. W. Jewell
Vice President in Charge of Operation
October 21, 1960

[fol. 6102] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Warren Rural Electric Cooperative Corporation
Bowling Green, Kentucky

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,343.3	50.7	55.2
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	523.4	975.4	1,360.0
3. Copper wire and cable covered and insulated[3]	620.7	74.5	41.6
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	X	308.1	354.3

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Chas. M. Stewart
Manager
October 14, 1960

[fol. 6103] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Warren Rural Electric Cooperative Corporation
Bowling Green, Kentucky

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Chas. M. Stewart
Manager
October 14, 1960

[fol. 6104] United States Department of Justice

Schedule III

Warren Rural Electric Cooperative Corporation
Bowling Green, Kentucky

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

Chas. M. Stewart
Manager
October 14, 1960

[fol. 6105] United States Department of Justice

Schedule IV

Warren Rural Electric Cooperative Corporation
Bowling Green, Kentucky

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Chas. M. Stewart
Manager
October 14, 1960

[fol. 6106] Water Light Power Heat
Board of Water and Light
Lansing 3, Michigan

October 20, 1960

United States Department of Justice
Washington, D. C.

Att'n: Mr. Robert A. Bicks,
Assistant Attorney General
Antitrust Division

Re: RAB:CLW
60-0-37-256

Gentlemen:

In response to your letter of October 11th, we are enclosing the information you requested so far as we are able to do so.

Very truly yours,

Board of Water and Light
O. E. Eckert
General Manager

OEE:jt

[fol. 6107] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Board of Water and Light
116 West Ottawa Street, Lansing 3, Michigan

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare		None in service	
2. Aluminum and aluminum alloy wire and cable-bare & ACSR		None in service	
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2.15	10.75	51.05
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	101.30
3. Copper wire and cable covered and insulated[3]	834.34	1145.98	779.55
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	12.11	115.37

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. E. Eckert
General Manager
October 19, 1960

[fol. 6108] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Board of Water and Light
116 West Ottawa Street, Lansing 3, Michigan

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx
1. Copper		None in service	
2. Aluminum & Aluminum Alloy		None in service	
B. Distribution cable	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx
1. Copper *	212.21	135.55	162.71
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

(*) This total included Street Light Underground Cable in the following amounts:

1950	1955	1959
5.81	53.61	99.57

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. E. Eckert
General Manager
October 19, 1960

[fol. 6109] United States Department of Justice

Schedule III

Board of Water and Light
116 West Ottawa Street
Lansing 3, Michigan

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

O. E. Eckert
General Manager
October 19, 1960

[fol. 6110] United States Department of Justice

Schedule IV

Board of Water and Light
116 West Ottawa Street
Lansing 3, Michigan

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Restricted by size of existing ducts.

O. E. Eckert
General Manager
October 19, 1960

TBE/mj

[fol. 6111] The Detroit Edison Company
2000 Second Avenue
Detroit 26, Michigan

May 3, 1961

Miss Edna Lingreen, Attorney
Antitrust Division
United States Department of Justice
Washington, D.C.

Dear Miss Lingreen:

This will confirm our conversation on May 3.

In accordance with your suggestion and in response to the subpoena which was delivered to me, I am enclosing schedules I and II showing our gross additions to overhead and underground conductors of the type on which you requested information.

I understand that by sending these schedules, it will not now be necessary for me to appear in the Federal Building in Detroit on Tuesday, May 9, 1961, and that you will confirm this to me in writing.

Very truly yours,

C. F. Ogden

[fol. 6112] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Detroit Edison Company
2000 Second Avenue, Detroit 26, Michigan

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	782	364	489
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,239	2,359	924
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	15	99	32
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4,451	3,504	5,039
3. Copper wire and cable covered and insulated[3]	31,680	10,556	4,594
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	25,929	12,300

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. F. Ogden
Vice President
May 3, 1961

[fol. 6113] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Detroit Edison Company
2000 Second Avenue, Detroit 26, Michigan

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	558	1,001	475
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,019	1,066	500
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. F. Ogden
Vice President
May 3, 1961

[fol. 6114] Electric and Gas Service
Consumers Power Company
General Offices - Jackson, Michigan

October 27, 1960

Reference RAB:CAW
60-0-37-256

Mr. Robert A. Bicks
United States Department of Justice
Antitrust Division
Washington, D. C.

Dear Mr. Bicks

Attached are the requested Schedules I, II, III and IV supplying information relative to Consumers Power Company use of aluminum and copper conductor for new construction and replacement.

Yours very truly,

Harold T. Belcher

HTB:fl
Attach.

[fol. 6115] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Consumers Power Company
212 West Michigan Avenue, Jackson, Michigan

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	113.5	286.1	178.6
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5,246.0	6,362.8	2,479.3
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	502.1	319.5	181.7
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	10,241.9	14,540.2	11,589.4
3. Copper wire and cable covered and insulated[3]	16,235.3	1,455.6	1,332.2
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—0—	17,771.4	14,750.1

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold T. Belcher
Director of Purchases and Stores
October 27, 1960

[fol. 6116] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Consumers Power Company
212 West Michigan Avenue, Jackson, Michigan

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	2.2	5.6	—0—
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	61.8	52.8	81.1
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold T. Belcher
Director of Purchases and Stores
October 27, 1960

[fol. 6117] United States Department of Justice

Schedule III

Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Expect proportion of aluminum to increase in future. We now use copper conductor for match-up purposes on multicircuit structures and for replacements. This use will become a smaller percentage in the future as the total line mileage increases. There will be some expansion likely of our present broad use of aluminum for distribution secondaries.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Harold T. Belcher
Director of Purchases and Stores
October 27, 1960

[fol. 6118] United States Department of Justice

Schedule IV

Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Expect aluminum proportion to increase in future as more buried cable (no duct system) is used on our transmission and distribution systems.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes, largely because of sizes of ducts in existing duct runs.

Harold T. Belcher
Director of Purchases and Stores
October 27, 1960

[fol. 6119] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Cincinnati Gas & Electric Company & Subsidiaries
Cincinnati, Ohio

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	110.7	12.7	5.4
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	99.0	624.7	154.6
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1400.7	2157.9	1313.0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	198.0	380.0	618.7
3. Copper wire and cable covered and insulated[3]	8432.5	7651.5	11460.8
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	.0	157.5	233.8

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total; for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. S. Fields
President
October 24, 1960

[fol. 6120] United States Department of Justice

Schedule II

Gross Additions [1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**The Cincinnati Gas & Electric Company & Subsidiaries
Cincinnati, Ohio**

Type of Underground Cable	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	.0	.0	3.7
2. Aluminum & Aluminum Alloy	.0	.0	.0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	399.2	498.2	500.4
2. Aluminum & Aluminum Alloy	.0	.0	.0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

E. S. Fields
President
October 24, 1960

[fol. 6121] United States Department of Justice

Schedule III

The Cincinnati Gas & Electric Company & Subsidiaries
Cincinnati, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We are using aluminum exclusively for service drops in 1960 so that item B4 will be increased in the amount of 5,000,000 feet and B3 will be reduced by this amount.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We limit the use of aluminum conductor to applications that do not require a large number of tapped connections.

E. S. Fields
President
October 24, 1960

[fol. 6122] United States Department of Justice

Schedule IV

The Cincinnati Gas & Electric Company & Subsidiaries
Cincinnati, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not use underground construction extensively except in high load density areas where duct sizes limit us to the use of copper.

E. S. Fields
President
October 24, 1960

[fol. 6123]

City of Cleveland
Department of Public Utilities
Division of Utilities Engineering

Sixth Floor, Lincoln Building
Cleveland 14, Ohio

November 21, 1960

Mr. Robert A. Bicks,
Assistant Attorney General
Antitrust Division
U. S. Department of Justice
Washington 25, D.C.

Ref: RAB:CLW
60-0-37-256

Dear Sir:

Your letter of November 16, 1960 was forwarded to this office. We wish to state that up until the last two (2) years, the Division of Light and Power has been using copper for both underground and overhead circuits. For 1961 we intend to use more aluminum than ever for the overhead circuits. The underground circuits will remain in copper.

We are budgeting for the following aluminum and copper wire quantities for 1961:

Quant.	*Description*
33,000′	#4 ACSR—W.P.—Neo/Poly
25,000′	#2 ACSR—W.P.—Neo/Poly
25,000′	1/0 ACSR—W.P.—Neo/Poly
3,000′	3/0 ACSR—W.P.—Neo/Poly
20,000′	366.4 ACSR Bare
100,000′	#4 Al—Str W.P.—Neo/Poly
50,000′	#4 Al—Str Bare
25,000′	#2—Al—Str W.P.—Neo/Poly
25,000′	#2—Al—Str Bare
50,000′	1/0 Al—Str W.P. Neo/Poly
75,000′	#6 Cu, Sol H.D. W.P. Neo/Poly
25,000′	#4 Cu, Sol H.D. W.P. Neo/Poly

[fol. 6124]

Quant.	*Description*
25,000′	#2 Cu, Sol., H.D. W.P. Neo/Poly
5,000′	1/0 Cu, Str. S.D. W.P. Neo/Poly
30,000′	4/0 Cu, Str. S.D. W.P. Neo/Poly
200,000′	Triplex, Poly, Bare Al Neut. #4
50,000′	Triplex, Poly, Bare Al Neut. #2
20,000′	Triplex, Poly, Bare Al Neut. #1/0

Very truly yours,

George C. Paraskeva
Chief Electrical Engr.
622 Lincoln Bldg.
E. 6th & St. Clair Ave.
Cleveland 14, Ohio

GCP/el

[fol. 6125] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Cleveland Electric Illuminating Company
55 Public Square

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	289.3	346.9	337.4
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	.0	2,672.1	2,447.4
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	.0	.0	1,133.1
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	.0	.0	467.5
3. Copper wire and cable covered and insulated[3]	11,097.9	10,851.3	1,181.6
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	.0	1,770.3	8,066.4

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. S. Shane
Manager, Costs & Record Department
October 26, 1960

[fol. 6126] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Cleveland Electric Illuminating Company
55 Public Square

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	328.4	461.3	562.7
2. Aluminum & Aluminum Alloy	.0	.0	.0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	741.1	300.3	266.7
2. Aluminum & Aluminum Alloy	.0	.0	.0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. S. Shane
Manager, Costs & Record Department
October 26, 1960

[fol. 6127] United States Department of Justice

Schedule III

The Cleveland Electric Illuminating Company
55 Public Square

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

There are so many factors that must be considered it would be impossible to forecast whether or not any future change would be made in present practice.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Harold L. Williams
Manager, Trans. & Dist. Engrg. Dept.
October 26, 1960

[fol. 6128] United States Department of Justice

Schedule IV

The Cleveland Electric Illuminating Company
55 Public Square

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

This company does not currently use aluminum conductors for underground installations. There are so many factors that must be considered that it would be impossible to forecast whether or not any future changes in this practice would be made.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

This company does not currently use aluminum conductors for underground installations.

Harold L. Williams
Manager, Trans. & Dist. Engrg. Dept.
October 26, 1960

[fol. 6129] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Ohio Edison Company
47 North Main St., Akron 8, Ohio

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	176	176	84
Copperweld wire	109	36	19
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	814	2,655	8,709
B. Distribution lines (all wire and cable contluctors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,791	658	597
Copperweld wire	25,301	4,343	1,471
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2,848	34,360	14,531
3. Copper wire and cable covered and insulated[3]	13,431	2,540	783
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	63	9,545

See Note Below

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note: Data with respect to the quantity of conductors of each classification shown above used in connection with maintenance are not readily available from the books and records of the company. To compile such data from such books and records would require a detailed analysis of all stores requisitions for each of the three years and would considerably delay the completion of this questionnaire; also would entail considerable effort and expense. It is estimated that the quantities of the respective subject conductors used in connection with maintenance in each of the years indicated above were of minor significance.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Otto Brunenmeister, Jr.
Vice President
November 18, 1960

[fol. 6130] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Ohio Edison Company
47 North Main St., Akron 8, Ohio

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1	34	5
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	226	369	234
2. Aluminum & Aluminum Alloy	—	—	—

See Note on Sched. I

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Otto Brunenmeister, Jr.
Vice President
November 18, 1960

[fol. 6131] United States Department of Justice

Schedule III

Ohio Edison Company
47 North Main St., Akron 8, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We do not expect any increase or decrease in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines) in 1960 or subsequent years.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals. We do not use insulated aluminum conductors for secondary overhead lines (600 volts and below) larger than #2 copper equivalent because of the bulk of these larger size insulated aluminum conductors.

Otto Brunenmeister, Jr.
Vice President
November 18, 1960

[fol. 6132] United States Department of Justice

Schedule IV

Ohio Edison Company
47 North Main St., Akron 8, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We do not expect any increase or decrease in 1960 or subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables).

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do restrict the use of aluminum conductors for underground cables because of space limitations, size of existing ducts, connector problems and cost.

Otto Brunenmeister, Jr.
Vice President
November 18, 1960

[fol. 6133] **United States Department of Justice**

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Ohio Power Company
301 Cleveland Ave., S.W., Canton, Ohio

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	9	253	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	669	6717	700
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	822	284	37
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	3295	2552	3708
3. Copper wire and cable covered and insulated[3]	1500	760	66
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	6000	6840	6582

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Junge
Chief Statistician
November 1, 1960

[fol. 6134] United States Department of Justice

Schedule II

Gross Additions [1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Ohio Power Company
301 Cleveland Ave., S.W., Canton, Ohio

Type of Underground Cable	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission cable	xxxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1.3	58	2.4
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limtiations and qualifications as set forth in my letter of November 1, 1960.

Douglas Junge
Chief Statistician
November 1, 1960

[fol. 6135] United States Department of Justice

Schedule III

Ohio Power Company
301 Cleveland Ave., S.W., Canton, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Salt water not a problem for this area. ACSR used mostly because of resistance to acid corrosion.

Douglas Junge
Chief Statistician
November 1, 1960

[fol. 6136] United States Department of Justice

Schedule IV

Ohio Power Company
301 Cleveland Ave., S.W., Canton, Ohio

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes. Its use is restricted because we are not sure of the long range effect of corrosion of aluminum in contact with moisture where a limited supply of oxygen is available. We are hopeful for an answer to this problem within the next 5 years.

Douglas Junge
Chief Statistician
November 1, 1960

[fol. 6137] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Wisconsin Electric Power Company
231 W. Michigan Street, Milwaukee 1, Wisconsin

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx
1. Copper wire and cable-bare	222	124	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	616	951	2,055
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxxx	xxxxxxxxx	xxxxxxxxx
1. Copper wire and cable-bare	1,434	4,231	1,810
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	687	1,722	1,661
3. Copper wire and cable covered and insulated[3]	9,657	9,536	4,329
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	6,193	12,265

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Alfred Gruhl
Executive Vice President
October 31, 1960

[fol. 6138] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Wisconsin Electric Power Company
231 W. Michigan Street, Milwaukee 1, Wisconsin

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	193	362	474
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	419	507	247
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Alfred Gruhl
Executive Vice President
October 31, 1960

[fol. 6139] United States Department of Justice

Schedule III

Wisconsin Electric Power Company
231 W. Michigan Street
Milwaukee 1, Wisconsin

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

It is expected that the proportion of aluminum conductor used for overhead lines will continue high in 1960. This will probably also be true for subsequent years unless there are price changes which would again favor copper.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum conductor is not restricted in this company's area because of salt water or other corrosion problems.

Alfred Gruhl
Executive Vice President
October 31, 1960

[fol. 6140] United States Department of Justice

Schedule IV

Wisconsin Electric Power Company
231 W. Michigan Street
Milwaukee 1, Wisconsin

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

It is not expected that there will be any change in the use of copper for underground conductor in 1960 or in subsequent years unless price differentials change substantially.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Space limitations in existing ducts and manholes are a definite factor limiting the use of aluminum conductor.

Alfred Gruhl
Executive Vice President
October 31, 1960

[fol. 6141] Utilities

Region III North Central

State	Name
Iowa	Iowa Power & Light Co.
Kansas	Board of Public Utilities—Kansas City
Kansas	Kansas Gas & Electric Co.
Kansas	Kansas Power & Light Co.
Minn.	Lake Region Co-op Electric Association
Minn.	Northern States Power Co.
Missouri	Kansas City Power & Light Co.
Missouri	Union Electric Co.
Nebraska	———
North Dakota	Nodak Rural Electric Coop Inc.
North Dakota	Otter Tail Power Co.
North Dakota	Montana-Dakota Utilities Co.
South Dakota	Black Hills Power & Light Co.

[fol. 6142] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Iowa Power and Light Company
823 Walnut Street

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	18.9	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	—
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	332.7	605.7	56.6
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	92.7	18.0	1387.2
3. Copper wire and cable covered and insulated[3]	2176.1	1786.1	963.5
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	18.3	83.0	390.1

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, fcr all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. G. Hally
Engr. in Charge Trans. & Distr.
October 31, 1960

[fol. 6143] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Iowa Power and Light Company
823 Walnut Street

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	66.2	53.6	30.2
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. G. Hally
Engr. in Charge Trans. & Distr.
October 31, 1960

[fol. 6144] United States Department of Justice

Schedule III

Iowa Power and Light Company
823 Walnut Street 3, Des Moines, Iowa

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

The proportion of aluminum to copper should remain about the same.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

H. G. Hally
Engr. in Charge Trans. & Distr.
October 31, 1960

[fol. 6145] United States Department of Justice

Schedule IV

Iowa Power and Light Company
823 Walnut Street, Des Moines, Iowa

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions—However the added expense for duct space and insulation have not encouraged us to use aluminum.

H. G. Hally
Engr. in Charge Trans. & Distr.
October 31, 1960

[fol. 6146] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Board of Public Utilities
City Hall, Kansas City 1, Kansas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	178.6
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	59.8	251.9	363.4
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	47.1	62.2
3. Copper wire and cable-covered and insulated[3]	656.1	970.5	558.1
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	—	56.5

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. J. Duvall
Manager of Production and Distribution
November 9, 1960

[fol. 6147] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Board of Public Utilities
City Hall, Kansas City 1, Kansas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	117.2	49.0	37.0
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. J. Duvall
Manager of Production and Distribution
November 9, 1960

[fol. 6148] United States Department of Justice

Schedule III

Board of Public Utilities
City Hall, Kansas City 1, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No appreciable increase anticipated.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No limiting conditions.

R. J. Duvall
Manager of Production and Distribution
November 9, 1960

[fol. 6149] United States Department of Justice

Schedule IV

Board of Public Utilities
City Hall, Kansas City 1, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No changes planned.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, sise of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions or limitations.

R. J. Duvall
Manager of Production and Distribution
November 9, 1960

[fol. 6150] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kansas Gas and Electric Company
P. O. Box 208, Wichita 1, Kansas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	199.98	—	7.33
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	425.86	945.77	34.56
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	6,430.12	3,460.32	950.27
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	402.00	3,268.33	1,812.63
3. Copper wire and cable covered and insulated[3]	6901.5	40	550
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	3645	2245

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Quantities in total are quite accurate; breakdown between Transmission and Distribution is necessarily estimated.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

S. J. Sickel
Vice President—Operations
December 12, 1960

[fol. 6151] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kansas Gas and Electric Company
P. O. Box 208, Wichita 1, Kansas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	199.98	—	7.33
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	425.86	945.77	34.56
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	6430.12	3460.32	950.27
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	402.00	3268.33	1812.63
3. Copper wire and cable covered and insulated[3]	negligible	negligible	negligible
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	negligible	negligible	negligible

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Quantities in total are quite accurate; breakdown between transmission and distribution is necessarily estimated.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

S. J. Sickel
Vice President—Operations
December 2, 1960

[fol. 6152] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kansas Gas and Electric Company
P. O. Box 208, Wichita 1, Kansas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	7.97	10.55	11.51
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

S. J. Sickel
Vice President—Operations
December 2, 1960

[fol. 6153] United States Department of Justice

Schedule III

Kansas Gas and Electric Company
P.O. Box 208, Wichita 1, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Expect 1959 proportion will generally apply in future, unless relative costs change substantially.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No problem hence no limitations.

S. J. Sickel
Vice President—Operations
December 2, 1960

[fol. 6154] United States Department of Justice

Schedule IV

Kansas Gas and Electric Company
P.O. Box 208, Wichita 1, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change anticipated unless relative costs change substantially.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

S. J. Sickel
Vice President—Operations
December 2, 1960

[fol. 6155] The Kansas Power and Light Company
800 Kansas Avenue
Topeka, Kansas

December 13, 1960.

Mr. Robert A. Bicks,
Assistant Attorney General,
Antitrust Division,
United States Department of Justice,
Washington, D.C.

Dear Mr. Bicks: Re: RAB:CLW
60-0-37-256

At your request, we have prepared revised Schedule I to show estimated feet in place of pounds of wire in the various categories of distribution lines. It is enclosed herewith together with Schedules II to IV, inclusive, which we have re-executed under current date on forms supplied by you with your letter of December 6, 1960.

Very truly yours,

Balfour S. Jeffry,
President.

[fol. 6156] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for each of the Years 1950, 1955 and 1959[6]

The Kansas Power and Light Company
800 Kansas Avenue, Topeka, Kansas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare[4]	806	408	8
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	152	1256	604
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)[3]	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare[4]	8951	1306	346
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	212	71	1247
3. Copper wire and cable covered and insulated[3, 4]	2936	1059	281
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	60	22	371

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] Includes Copperweld.

[5] Estimated (See below)[*]

[6] Revised Report.

[*] Because records are kept primarily on the basis of pounds, the indicated figures are estimated on the basis of feet per pound for the type of wire used in each category.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Balfour S. Jeffry
President
December 13, 1960

[fol. 6157] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Kansas Power and Light Company
800 Kansas Avenue, Topeka, Kansas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	4	4	5
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Balfour S. Jeffry
President
December 13, 1960

[fol. 6158] United States Department of Justice

Schedule III

The Kansas Power and Light Company
800 Kansas Avenue
Topeka, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No, not appreciably. Decisions, however are made on the basis of relative costs and particular job requirements.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Balfour S. Jeffry
President
December 13, 1960

[fol. 6159] United States Department of Justice

Schedule IV

The Kansas Power and Light Company
800 Kansas Avenue
Topeka, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Probably not, because of present superior qualities of copper.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes, for reasons of corrosion and size.

Balfour S. Jeffry
President
December 13, 1960

[fols. 6160-6161] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Kansas Power and Light Company
800 Kansas Avenue, Topeka, Kansas
See Attached Sheet

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare [4]			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR [4]			
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare [4]			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR [4]			
3. Copper wire and cable covered and insulated [3, 4]			
4. Aluminum and aluminum alloy wire and cable covered and insulated [3, 4]			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] Company statistics are not maintained which would enable us to readily furnish data in above categories. On an attached sheet are shown all types of conductor in M-ft. and conductors by metal in M-lbs.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Balfour S. Jeffry
President
October 20, 1960

[fol. 6162] **Schedule I**

Gross Additions of Overhead Electrical Conductor to Electric Utility Plant for each of the Years 1950, 1955 and 1959.

The Kansas Power and Light Company
800 Kansas Avenue, Topeka, Kansas

	1950	1955	1959
A. Transmission Lines			
1 & 2 All types of conductors in thousands of feet	273	508	201
Conductor in thousands of pounds by kind			
Copper	31	10	2
Copperweld	193	37	1
Aluminum	7	736	12
B. Distribution Lines			
1-4 All types of conductor in thousands of feet	12,159	2,458	2,245
Conductor in thousands of pounds by kind			
Copper	425	320	77
Copperweld	612	173	41
Aluminum	21	150	235

[fol. 6163] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Kansas Power and Light Company
800 Kansas Avenue, Topeka, Kansas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	4	4	5
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Balfour S. Jeffry
President
October 20, 1960

[fol. 6164] United States Department of Justice

Schedule III

The Kansas Power and Light Company
800 Kansas Avenue
Topeka, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No, not appreciably. Decisions, however are made on the basis of relative costs and particular job requirements.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Balfour S. Jeffry
President
October 20, 1960

[fol. 6165] United States Department of Justice

Schedule IV

The Kansas Power and Light Company
800 Kansas Avenue
Topeka, Kansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Probably not, because of present superior qualities of copper.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes, for reasons of corrosion and size.

Balfour S. Jeffry
President
October 20, 1960

[fol. 6166] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Lake Region Co-op. Electric Ass'n.
Pelican Rapids, Minnesota

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—0—	—0—	—0—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	316.8	—0—	—0—
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—0—	—0—	—0—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2,275.6	528.0	372.5
3. Copper wire and cable covered and insulated[3]	227	—0—	—0—
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—0—	37.5	52.5

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Clarence W. Peterson
Manager
October 25, 1960

[fol. 6167] United States Department of Justice

Schedule III

Lake Region Co-op Electrical Ass'n.
Pelican Rapids, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No increase is contemplated primarily because we now use aluminum extensively.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No limitations placed on the use of aluminum. Experience with aluminum conductors has been very favorable, in fact, mechanically it has proven more favorable than copper.

Clarence W. Peterson
Manager
October 25, 1960

[fol. 6168] Northern States Power Company
Minneapolis 2, Minnesota

October 31, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D.C.

Dear Mr. Bicks: Subject: RAB:CLW
60-0-37-256

In response to your request of October 11th, we are attaching data with respect to our use of aluminum and copper conductor for calendar years 1950-1955 and 1959 and answers to the other questions included in the questionnaire attached thereto. This data relates to our Northern States Power Co. (Minn.) operations.

The figures, as to transmission and distribution overhead and underground lines, have been developed from our statistical and property records. Considering the fact that it would not be possible to produce actual quantities of service wire subdivided between copper and aluminum and an actual count of the number of 2 wire versus 3 wire services, for the three years under consideration within the time allotted, we have calculated these quantities based on an estimate as outlined in note (a) on the questionnaire.

We trust that you will find our figures compiled as above indicated entirely satisfactory and acceptable for your purpose.

Very truly yours, A. H. Hamilton, Manager of Purchasing.

AHHamilton:mm

[fol. 6169] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Northern States Power Co. (Minn.)
Minneapolis 2, Minnesota

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	89	136	44
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1216	4609	1671
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	2976	1227	406
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	788	2420	4395
3. Copper wire and cable covered and insulated[3]	7110(a)	4554(a)	1228(a)
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	3524(a)	5242(a)	8734(a)

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note (a) Total includes estimated quantity of service conductor (at average length of 77 ft) as follows:

1950 Actual number of services 20422—30% Copper 70% aluminum
1955 Actual number of services 21653— 5% Copper 95% aluminum
1959 Actual number of services 23027— 5% Copper 95% aluminum

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. See exception as per note (a).

A. H. Hamilton
Manager of Purchasing
October 31, 1960

[fol. 6170] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Northern States Power Co. (Minn.)
Minneapolis 2, Minnesota

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	18	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	266	487	97
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

A. H. Hamilton
Manager of Purchasing
October 31, 1960

[fol. 6171] United States Department of Justice

Schedule III

Northern States Power Co. (Minn.)
Minneapolis 2, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change expected.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restriction or limitation on the use of aluminum.

A. H. Hamilton
Manager of Purchasing
October 31, 1960

[fol. 6172] United States Department of Justice

Schedule IV

Northern States Power Co. (Minn.)
Minneapolis 2, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change expected.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum conductor for underground cables is limited because of size of existing ducts.

A. H. Hamilton
Manager of Purchasing
October 31, 1960

[fol. 6172a] Kansas City Power & Light Company
1330 Baltimore Avenue
Kansas City 41, Missouri

October 20, 1960

Mr. Robert A. Bicks
Asst. Attorney General
United States Department of Justice
Washington, D. C.

RE: 60-0-37-256

Dear Mr. Bicks:

At the request of Mr. R. B. Harman of the Federal Bureau of Investigation we are attaching four schedules covering information concerning the relative use of aluminum and copper conductor in our company.

In preparing this data it was necessary for us to make some assumptions with respect to minor items such as our service drops and street light standards but in our opinion the assumptions we made would not influence the total picture.

Yours very truly, R. O. Linville.

ROL:mn
attach.

cc: Mr. R. B. Harman
Federal Bureau of Investigation
Box 2449
Kansas City, Missouri
Mr. R. A. Olson

[fol. 6173] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kansas City Power & Light Company
1330 Baltimore Avenue, Kansas City, Missouri

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	108	10	38
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	42	370	212
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	2,463	1,515	477
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	238	3,592	2,012
3. Copper wire and cable covered and insulated[3]	2,919	2,082	394
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	2,475	5,854	4,743

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. O. Linville
Controller
October 20, 1960

[fol. 6174] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kansas City Power & Light Company
1330 Baltimore Avenue, Kansas City, Missouri

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	43
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx.	xxxxxxxx
1. Copper	557	369	538
2. Aluminum & Aluminum Alloy			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. O. Linville
Controller
October 20, 1960

[fol. 6175] United States Department of Justice

Schedule III

Kansas City Power & Light Company
1330 Baltimore Avenue
Kansas City, Missouri

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

The company is using substantially all aluminum conductor for its overhead lines at the present time. We do not contemplate any change in this arrangement.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have no restrictions concerning the limits for the use of aluminum conductor because of corrosion or other reasons.

R. O. Linville
Controller
October 20, 1960

[fol. 6176] United States Department of Justice

Schedule IV

Kansas City Power & Light Company
1330 Baltimore Avenue
Kansas City, Missouri

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

The company is using copper conductor entirely in its underground system except in a few minor experimental areas. We do not contemplate any change in this program in the near future.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have no restrictions on the use of aluminum conductor for underground cable except the normal economic restrictions that have existed for some time.

R. O. Linville
Controller
October 20, 1960

[fol. 6177] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Union Electric Company
St. Louis, Missouri

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	520	5	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	178	1,081	2,835
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	3,014	3,573	2,251
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	3,460	3,438	4,579
3. Copper wire and cable covered and insulated[3]	10,421	7,761	5,223
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	75	4,384	5,576

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. B. Covell
Superintendent of Supply Service
November 10, 1960

[fol. 6178] United States Department of Justice

Schedule II

Gross Additions [1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Union Electric Company
St. Louis, Missouri

Type of Underground Cable	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	16	7	9
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	570	549	570
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. B. Covell
Superintendent of Supply Service
November 10, 1960

[fol. 6179] United States Department of Justice

Schedule III

Union Electric Company
St. Louis, Missouri

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We do not anticipate any significant change in the proportion of aluminum to copper to be purchased for use in the classification of Schedule I (Overhead Lines). Our selection of the appropriate metal for several years has been premised on the relative installed economy of the two types of conductors of comparable capacity.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have no current restrictions or limitations on the use of aluminum conductors for overhead lines because of corrosion. Problems were experienced with connectors in the early years of use several years ago but developments subsequently overcame these difficulties.

M. B. Covell
Superintendent of Supply Service
November 10, 1960

[fol. 6180] United States Department of Justice

Schedule IV

Union Electric Company
St. Louis, Missouri

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No comments. See "B" below.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have not found it economical to utilize aluminum conductors for underground applications. The relative size of the aluminum conductor of comparable carrying capacity to copper appears to preclude any possible use for underground applications as this element substantially effects the total cost of installed circuits of comparable load carrying capacity.

M. B. Covell
Superintendent of Supply Service
November 10, 1960

[fol. 6181] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Nodak Rural Electric Cooperative, Inc.
Grand Forks, North Dakota

Type of Overhead Line	Answer in Thousands of Feet[2] 1950 *	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare		690	403
2. Aluminum and aluminum alloy wire and cable-bare & ACSR		642	306
3. Copper wire and cable covered and insulated[3]		108	119
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]		—0—	44

* Detailed records not available.

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[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

James F. Coleman
Manager
October 27, 1960

[fol. 6182] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Nodak Rural Electric Cooperative, Inc.
Grand Forks, North Dakota**

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy		—0—	1

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

James F. Coleman
Manager
October 27, 1960

[fol. 6183] United States Department of Justice

Schedule III

Nodak Rural Electric Cooperative, Inc.
Grand Forks, North Dakota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

If prices between copper and aluminum remain on the present ratio, we anticipate that future construction on our overhead main multiphase line will consist almost entirely of aluminum ACSR conductor. Most of the anticipated system improvements will be in the larger sizes of conductor (1/0, 2/0, and 3/0). The construction economics are highly favorable toward aluminum in these sizes.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not incur salt water conditions in this area; however, do find at substation locations serving chemical installations, copper seems more resistant to corrosion.

James F. Coleman
Manager
October 27, 1960

[fol. 6184] United States Department of Justice

Schedule IV

Nodak Rural Electric Cooperative, Inc.
Grand Forks, North Dakota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Due to the small amount of underground cable used in our operations, our anticipated use would be almost exclusively copper.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Due to the small amount of underground cable used in our operations, our anticipated use would be almost exclusively copper. Copper underground cable preferred on small quantity basis because of space limitations in ducts and greater resistance, due to soil conditions.

James F. Coleman
Manager
October 27, 1960

[fol. 6185] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Otter Tail Power Company
Fergus Falls, Minnesota

Type of Overhead Line	Answer in Thousands of Feet[2] [4] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	235	9	559
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4,114	3,223	2,560
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	533	355	705
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	554	717	420
3. Copper wire and cable covered and insulated[3]	1,832	723	437
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	373	1,457	2,397

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] All of our accounting records indicate conductors in pounds. We have used an average weight per foot conversion factor in each classification to give you the information requested.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Wannler Nye
Vice President
October 20, 1960

[fol. 6186] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Otter Tail Power Company
Fergus Falls, Minnesota

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Wannler Nye
Vice President
October 20, 1960

[fol. 6187] United States Department of Justice

Schedule III

Otter Tail Power Company
Fergus Falls, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None of the copper used in the years shown represents new purchases, except a portion of item B-3. We will continue to use the copper we now have on the system as it becomes available from salvaging and reconductoring operations.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Wannler Nye
Vice President
October 20, 1960

[fol. 6188] United States Department of Justice

Schedule IV

Otter Tail Power Company
Fergus Falls, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We have used no underground cable and do not anticipate future usage at this time.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Wannler Nye
Vice President
October 20, 1960

[fol. 6188a] Montana-Dakota Utilities Co.
Montana-Dakota Utilities Bldg.
831 Second Avenue South
Minneapolis 2

October 31, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Your File 60-0-37-256

Dear Sir:

As requested in your letter of October 11, 1960, to Mr. C. W. Smith, we enclose our data as to relative use of aluminum and copper conductor during the years 1950, 1955, and 1959.

Due to the widespread nature of our operations, it is impossible to state, within the time limit imposed on our reply, the footage of conductor actually installed. We have, therefore, shown the amounts received from suppliers during the years shown. The distortion of the relative amounts of aluminum and copper resulting from this substitution should be negligible.

Very truly yours, H. L. Pearson, Assistant Vice President.

HLP:L
Enc.
cc Mr. A. F. Anderson—Office

[fol. 6189] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Montana-Dakota Utilities Co.
831 Second Avenue South, Minneapolis 2, Minnesota

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	217	5082	2636
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	353	181	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
3. Copper wire and cable covered and insulated[3]	2440	197	None
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	1282	586

[1] Electrical conductor received for new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. L. Pearson
Assistant Vice President
October 31, 1960

[fol. 6190] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Montana-Dakota Utilities Co.
831 Second Avenue South, Minneapolis 2, Minnesota

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. L. Pearson
Assistant Vice President
October 31, 1960

[fol. 6191] United States Department of Justice

Schedule III

Montana-Dakota Utilities Co.
831 Second Avenue South
Minneapolis 2, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No changes foreseen.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions except in minor isolated instances.

H. L. Pearson
Assistant Vice President
October 31, 1960

[fol. 6192] United States Department of Justice

Schedule IV

Montana-Dakota Utilities Co.
831 Second Avenue South
Minneapolis 2, Minnesota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No underground system.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

H. L. Pearson
Assistant Vice President
October 31, 1960

[fol. 6193] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Black Hills Power and Light Company
P. O. Box 1951, Rapid City, South Dakota

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	328.4	58.3	41.1
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	555.0	278.1
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	434.6	165.4	37.2
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	501.8	823.5
3. Copper wire and cable covered and insulated[3]	972.2	352.7	22.9
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	470.3	622.8

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Robert G. Asheim
Vice President–Operations
October 28, 1960

[fol. 6194] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Black Hills Power and Light Company
P. O. Box 1951, Rapid City, South Dakota

Type of Underground Cable We have no underground.	Answer in Thousands of Feet[2] 1950	 1955	 1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Robert G. Asheim,
Vice President–Operations
October 28, 1960.

[fol. 6195] United States Department of Justice

Schedule III

Black Hills Power and Light Company
P. O. Box 1951, Rapid City, South Dakota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We will be using aluminum and ACSR exclusively in the future, except when retired conductor is reusable.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

Robert G. Asheim
Vice President–Operations
October 28, 1960

[fol. 6196] United States Department of Justice

Schedule IV

Black Hills Power and Light Company
P. O. Box 1951, Rapid City, South Dakota

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We have no underground now; however if the demand for underground should develop, we will make a decision at that time.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions or limitations because we have no underground.

Robert G. Asheim
Vice President–Operations
October 28, 1960

[fol. 6197] UNITED STATES DISTRICT COURT

Schedules Prepared by Electric Utilities Showing Use of Copper and Aluminum Conductor

Regions IV, V, VI and VII

[fol. 6198] Utilities

Region: IV Northwestern

State	Name
Idaho	Idaho Power Co.
Montana	Fergus Electric Coop. Inc.
Montana	Montana Power Co.
Oregon	Pacific Power & Light Co.
Washington	Inland Power & Light Co.
Washington	Seattle Department of Lighting
Washington	Tacoma Department of Public Utilities (Light Div.)
Washington	Washington Water Power Co.
Wyoming	Cheyenne Light Fuel & Power Co.
Wyoming	Lincoln Service Corp.

[fol. 6199] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Idaho Power Company
1220 Idaho Street, Boise, Idaho

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	92	3	36
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4,251	550	2,899
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	8,473	3,038	1,055
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	154	4,738	5,080
3. Copper wire and cable covered and insulated[3]	6,371	969	518
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	1,690	2,283

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

N. L. Scott
Purchasing Agent
October 28, 1960

[fol. 6200] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Idaho Power Company
1220 Idaho Street, Boise, Idaho

Type of Underground Cable	Answer in Thousands of Feet[2]		
	1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	82	37	3
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

N. L. Scott
Purchasing Agent
October 28, 1960

[fol. 6201] United States Department of Justice

Schedule III

Idaho Power Company
1220 Idaho Street, Boise, Idaho

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

N. L. Scott
Purchasing Agent
October 28, 1960

[fol. 6202] United States Department of Justice

Schedule IV

Idaho Power Company
1220 Idaho Street, Boise, Idaho

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes—for the reasons stated above.

N. L. Scott
Purchasing Agent
October 28, 1960

[fol. 6203] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Fergus Electric Cooperative, Inc.
Lewistown, Montana

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			700,272'
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	115,157'	285,666'	
2. Aluminum and aluminum alloy wire and cable-bare & ACSR		1,090,280	433,255
3. Copper wire and cable covered and insulated[3]	32,276'		
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]		41,745'	69,120'

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true,

J. F. Sharp
Assistant Manager
October 21, 1960

[fol. 6204] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Fergus Electric Cooperative, Inc.
Lewistown, Montana**

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—0—	—0—	—0—
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—0—	—0—	—0—
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

None used.

J. F. Sharp
Assistant Manager
October 21, 1960

[fol. 6205] United States Department of Justice

Schedule III

Fergus Electric Cooperative, Inc.
Lewistown, Montana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

If the price of copper conductors comes down we would use more copper wire.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

J. F. Sharp
Assistant Manager
October 21, 1960

[fol. 6206] United States Department of Justice

Schedule IV

Fergus Electric Cooperative, Inc.
Lewistown, Montana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

J. F. Sharp
Assistant Manager
October 21, 1960

[fol. 6207] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Montana Power Co.
40 East Broadway
Butte, Montana

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	175	15	3,525
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	232	498	1,644
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	5,924	659	566
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	3,016	4,588
3. Copper wire and cable covered and insulated[3]	1,767	141	34
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	1,612	1,508

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Sam. B. Chase
Vice President
October 25, 1960

[fol. 6208] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Montana Power Co.
40 East Broadway
Butte, Montana

Type of Underground Cable.	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	15	13	29
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Sam. B. Chase
Vice President
October 25, 1960

[fol. 6209] United States Department of Justice

Schedule III

The Montana Power Co.
40 East Broadway
Butte, Montana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Proportion of Aluminum will probably increase for overhead transmission lines; for distribution lines the proportion will remain about the same.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No such restriction in our service area.

Copper conductor was required in Yellowstone National Park construction in 1959 by government specification.

Sam. B. Chase
Vice President
October 25, 1960

[fol. 6210] United States Department of Justice

Schedule IV

The Montana Power Co.
40 East Broadway
Butte, Montana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change contemplated.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Very little underground conductor has been used in our system to date.

Sam. B. Chase
Vice President
October 25, 1960

[fol. 6211] Pacific Power & Light Company
Public Service Building
Portland 4, Oregon
December 9, 1960

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Ellery R. Fosdick

Dear Mr. Bicks:

In reply to the telephone inquiry of your Mr. Fosdick regarding the completed schedules submitted in response to your letter of October 11, 1960, we submit the following additional information.

1. The amounts shown in the schedules were compiled from our Purchasing Department records. However, as our inventories of wire and cable remain very stable from month to month, it is our opinion that the installation of wire and cable is very close to the amount of purchases in any year, and consequently, any difference is nominal.

2. The amount of wire and cable used in maintenance is negligible and therefore would not effect the quantity of wire installed in any year.

3. The general trend in our service area in the use of conductors, in both transmission and distribution, is toward aluminum conductors, except in areas adjacent to the Pacific Ocean which represent a small portion of our system.

Very truly yours,

Albert Bauer
General Manager

AB:ab

[fol. 6212] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pacific Power & Light Company
Portland, Oregon

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
*A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	39	23	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	207	2,432	1,633
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,473	4,592	1,741
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	220	2,426	2,869
3. Copper wire and cable covered and insulated[3]	10,448	1,822	1,837
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	150	3,419	4,952

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

* Because of the extreme difficulty to completely prepare an accurate statement of the amount of wire installed each year, the amount of wire purchased is used instead.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

D. R. McClung
President
10-24-60

[fol. 6213] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pacific Power & Light Company
Portland, Oregon

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
*A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
*B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	46	22	56
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

* Because of the extreme difficulty to completely prepare an accurate statement of the amount of wire installed each year, the amount of wire purchased is used instead.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

D. R. McClung
President
10-24-60

[fol. 6214] United States Department of Justice

Schedule III

Pacific Power & Light Company
Portland, Oregon

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We do not expect any increase or decrease in the proportion of aluminum to copper in 1960 or subsequent years. However, this will depend upon the proportion of conductor needed for transmission and distribution.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do limit the use of aluminum in a very few areas adjacent to the Pacific Ocean due to corrosion of aluminum by fog and salt contamination.

D. R. McClung
President
10-24-60

[fol. 6215] United States Department of Justice

Schedule IV

Pacific Power & Light Company
Portland, Oregon

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We do not expect to increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper use in any classification of underground cables.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductors for Underground cables is restricted due to space limitations in the size of existing ducts and also due to maintaining splice connections on aluminum underground cables because of cold flow of metals and tight connection problems.

D. R. McClung
President
10-24-60

[fol. 6216] Inland Power & Light Co.
E. 320 Second Ave.
Spokane 3, Washington
Phone RIverside 7-7151

December 1, 1960

Reference: RAB:CLW 60-0-37-256

Budget Bureau No. 43-6005, Approval Exp. 12-31-60.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

I am returning the questionnaire your office has asked us to complete regarding the use of aluminum and copper conductor in our operation.

It has been impossible for us to find time to do an accurate recount of the footage for those years; however, we have supplied information based on statistics for the years 1951, 1955, and 1958. The year of 1951 would be quite comparable to 1950, and the year of 1958 would approximate the year 1959.

Even in the figures submitted, the complete accuracy cannot be guaranteed; however, the relative percentages of aluminum versus copper we feel to be very close to the actual ratio.

I certainly hope that our delay in getting this information for you has not been a problem and that the questionnaire will be useful to you.

Very truly yours, Inland Power & Light Co., Vincent P. Slatt, Manager.

VPS:dkl
Enclosures (4)

[fol. 6217] United States Department of Justice

Schedule J

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Inland Power & Light Co.
E 320-2nd Ave., Spokane 3, Wash.

Type of Overhead Line	Answer in Thousands of Feet[2] 1951	1955	1958
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	404.7	186.3	426.1
3. Copper wire and cable covered and insulated[3]	52.6	53.7	106.6
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Above are estimates of our work.

Time not sufficient for an accurate footage figure.

V. P. Slatt
Manager
12-1-60

[fol. 6218] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Inland Power & Light Co.
E 320-2nd Ave., Spokane 3, Wash.

Type of Underground Cable	Answer in Thousands of Feet[2] 1951	1955	1958
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	2.0	2.0	2.0
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been estimated and to the best of my knowledge and belief is true.

V. P. Slatt
Manager
12-1-60

[fol. 6219] United States Department of Justice

Schedule III

Inland Power & Light Co.
East 320-2nd Ave., Spokane 3, Wash.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change expected.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No limitations on primary base. However, our utility has standardized on copper service drops. One reason is possible chemical reactions where aluminum enter older transformer secondary bushings and when attached to copper meter loops on residences or poles.

V. P. Slatt
Manager
12-1-60

[fol. 6220] United States Department of Justice

Schedule IV

Inland Power & Light Co.
East 320-2nd Ave., Spokane 3, Wash.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

V. P. Slatt
Manager
12-1-60

[fol. 6221] The City of Seattle
Department of Lighting
City Light Building
1015 Third Avenue
Seattle 4, Washington
Gordon S. Clinton, Mayor

October 26, 1960.

Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Robert A. Bicks,
Assistant Attorney General

Your Reference: RAB:CLW, 60-0-37-256

Gentlemen:

In accordance with your request dated October 11, 1960, we are submitting the attached questionnaire schedules numbered I, II, III and IV, relating to the use of aluminum and copper as conductor materials by the Department of Lighting of the City of Seattle.

You will note that we were unable to supply all the information required on Schedule I for the years 1950 and 1955; part of the reason for this is that some of our past records do not reflect, in respect to wire and cable use, the schedule's identification of "maintenance" as distinct from "new construction and replacement." We trust that the comments we offer on Schedule III will be sufficient to indicate the trend of our choices in regard to the two metals.

Yours very truly, Paul J. Raver, Superintendent of Lighting.

DP:gn
Attached: Schedules I, II, III, IV

[fol. 6222] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Seattle Department of Lighting
1015 Third Avenue, Seattle 4, Washington

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	123	0
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	No Record	293	200
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	No Record	140	487
3. Copper wire and cable covered and insulated[3]	No Record	No Record	3,600
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	0	1,059

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Paul J. Raver
Superintendent of Lighting
October 26, 1960

[fol. 6223] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Seattle Department of Lighting
1015 Third Avenue, Seattle 4, Washington

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	79.513	139.047	219.303
2. Aluminum & Aluminum Alloy	C	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Paul J. Raver
Superintendent of Lighting
October 26, 1960

[fol. 6224] United States Department of Justice

Schedule III

Seattle Department of Lighting
1015 Third Avenue, Seattle 4, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

230-KV & 115 KV Transmission: Aluminum (ACSR) will be used exclusively.

26-KV Subtransmission: No change from exclusive use of bare aluminum wire—standard since 1956—is foreseen. Bare copper wire was standard until 1956.
Primary (4-KV) & Secondary Distribution: Covered and insulated copper wire will continue to be used almost exclusively.

Services: Aluminum Triplex wire was adopted as standard in 1956 for residential and other small services. No change is contemplated.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Transmission & Subtransmission Lines: No restriction of aluminum conductor use on account of corrosion. Aluminum preferred on basis of economic considerations, including cost of conductor and supports for required conductor diameter and current rating. Distribution Lines: Problems associated with the making and changing of many copper-to-aluminum connections on the existing system are the principal limitation on use of aluminum conductor for low-voltage overhead lines.

Paul J. Raver
Superintendent of Lighting
October 26, 1960

[fol. 6225] United States Department of Justice

Schedule IV
Seattle Department of Lighting
1015 Third Avenue, Seattle 4, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No use of aluminum underground cables is contemplated for 1960 or expected in immediately subsequent years.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductor for underground cables has not been adopted for three reasons:

1. Insufficient progress has been made in simplifying splices and terminations of aluminum conductor;
2. Insufficient progress in solving corrosion problems encountered with aluminum underground cables has been achieved; and
3. For a given conduit size, current-carrying capacity of aluminum cables is considerably less than that of copper; in the case of 500-MCM network cables, 330 amperes for aluminum as against 405 amperes for copper.

Paul J. Raver
Superintendent of Lighting
October 26, 1960

[fol. 6226] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Department of Public Utilities
P. O. Box 1639, Tacoma 1, Wash.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	140	—	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	108	112
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	185	25	152
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	341	183
3. Copper wire and cable covered and insulated[3]	995	138	9
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	227	674

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. M. Boyles
Chief Electrical Engineer
October 21, 1960

[fol. 6227] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Department of Public Utilities
P. O. Box 1639, Tacoma 1, Wash.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	38	36	29
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. M. Boyles
Chief Electrical Engineer
October 21, 1960

[fol. 6228] United States Department of Justice

Schedule III

Department of Public Utilities
P. O. Box 1639, Tacoma 1, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No increase indicated on subsequent use of copper and aluminum conductors to date.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor

No restrictions or limitations imposed.

R. M. Boyles
Chief Electrical Engineer
October 21, 1960

[fol. 6229] United States Department of Justice

Schedule IV

Department of Public Utilities.
P. O. Box 1639, Tacoma 1, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Use of aluminum conductor power cable not anticipated at this time.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductors in existing copper underground system would increase inventory of connectors and cable.

R. M. Boyles
Chief Electrical Engineer
October 21, 1960

[fol. 6230] The Washington Water Power Company
Post Office Drawer 1445
Spokane 10, Washington

December 12, 1960.

United States Department of Justice,
Antitrust Division,
Washington, D. C.

Aluminum & Copper Conductor, RAB:CLW 60-0-37-256

Gentlemen:

Attached you will find Schedule No. 2 containing information on aluminum and copper underground electrical conductors, revised to eliminate control cables, as requested in your letter of December 6, 1960.

Very truly yours, C. E. Cannon, Chief Engineer.

CEC:1
Enc

[fol. 6231] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Washington Water Power Company
P. O. Box 1445, Spokane 10, Washington

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1899	5	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	98	865	3701
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3068	1946	675
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	240	3290	1612
3. Copper wire and cable covered and insulated[3]	3620	144	63
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	1832	1566

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. E. Cannon
Chief Engineer
October 28, 1960

[fol. 6232] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

The Washington Water Power Company
P. O. Box 1445, Spokane 10, Washington

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	29	13	17
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. E. Cannon
Chief Engineer
December 12, 1960

[fol. 6233] United States Department of Justice

Schedule III

The Washington Water Power Company
P. O. Box 1445, Spokane 10, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change is expected in the proportion of aluminum to copper indicated by the figures for 1959 in Schedule I.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

C. E. Cannon
Chief Engineer
October 28, 1960

[fol. 6234] United States Department of Justice

Schedule IV

The Washington Water Power Company
P. O. Box 1445, Spokane 10, Washington

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

For years, subsequent to 1960, there may be some increase in the use of aluminum for underground distribution cables.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Size of existing ducts is a factor in determining the economic feasibility of using aluminum underground distribution cables.

C. E. Cannon
Chief Engineer
October 28, 1960

[fol. 6235] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Cheyenne Light, Fuel & Power Company
108 West 18th Street, Cheyenne, Wyoming

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959[4]
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	0
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	10	83	26
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	56	176	463
3. Copper wire and cable covered and insulated[3]	167	76	48
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	80	175

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] These figures are partially estimated as the records are not completely closed for this year's work.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. D. Virtue
Vice-President
October 31, 1960

[fol. 6236] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Cheyenne Light, Fuel & Power Company
108 West 18th Street, Cheyenne, Wyoming

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959[*]
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	1	1
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

[*] These figures are partially estimated as the records are not completely closed for this year's work.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. D. Virtue
Vice-President
October 31, 1960

[fol. 6237] United States Department of Justice

Schedule III

Cheyenne Light, Fuel and Power Company
108 West 18th Street, Cheyenne, Wyoming

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change from 1959.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

W. D. Virtue
Vice-President
October 31, 1960

[fol. 6238] United States Department of Justice

Schedule IV

Cheyenne Light, Fuel and Power Company
108 West 18th Street, Cheyenne, Wyoming

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

It is considered that aluminum cable has not been proven as a satisfactory conductor for underground use.

W. D. Virtue
Vice-President
October 31, 1960

[fol. 6239] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Lincoln Service Corporation
Frontier, Wyoming

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	90
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	354
3. Copper wire and cable covered and insulated [3]	0	0	0
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

V. A. Bair
General Manager
October 25, 1960

[fol. 6240] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Lincoln Service Corporation
Frontier, Wyoming

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

V. A. Bair
General Manager
October 25, 1960

[fol. 6241] United States Department of Justice

Schedule III

Lincoln Service Corporation
Frontier, Wyoming

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Our specifications call for all aluminum or ACSR wire to be used in replacement and building of new transmission and distribution lines.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

V. A. Bair
General Manager
October 25, 1960

[fol. 6242] United States Department of Justice

Schedule IV

Lincoln Service Corporation
Frontier, Wyoming

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

At present our specifications do not call for underground cable of any type.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

V. A. Bair
General Manager
October 25, 1960

[fol. 6243] Utilities

Region: V Southwestern

State	Name
Arizona	Arizona Public Service Co.
Arizona	Salt River Project Agriculture Improvement & Power District
California	Imperial Irrigation District
California	Los Angeles Department of Water & Power
California	Pacific Gas & Electric Co.
California	Pasadena Municipal Light & Power Department
California	Southern California Edison Co.
Colorado	Mountain View Electric Association
Colorado	Public Service Co. of Colorado
Colorado	Southeast Colorado Power Association
New Mexico	Public Service Co. of New Mexico
Nevada	Southern Nevada Power Co.
Utah	Utah Power & Light Co.

[fol. 6244] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Arizona Public Service Company
P. O. Box 2591, Phoenix, Arizona

Type of Overhead Line	Answer in Thousands of Feet[2] 1950[4]	1955[4]	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,050 M ft	3,000 ft	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	12,526 M ft	932 M ft
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	4,206 M ft	302 M ft	378 M ft
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	6,875 M ft	8,654 M ft
3. Copper wire and cable covered and insulated[3]	2,523 M ft	190 M ft	240 M ft
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0 M ft	4,120 M ft	5,136 M ft

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] The above figures for 1959 are actual from purchasing records and pole line mile records from FPC reports. The 1950 and 1955 figures are based on FPC reports, pole line mile records and estimates based on kva of load added during those years. Since some of the quantities are estimated there may be a variance with actual Purchase Orders.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. H. Foreman
Exec. Vice President
October 27, 1960

[fol. 6245] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Arizona Public Service Company
P. O. Box 2591, Phoenix, Arizona

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	29 M ft	100 M ft	57 M ft
2. Aluminum & Aluminum Alloy			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. H. Foreman
Exec. Vice President
October 27, 1960

[fol. 6246] United States Department of Justice

Schedule III

Arizona Public Service Company
P. O. Box 2591, Phoenix, Arizona

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

G. H. Foreman
Exec. Vice President
October 10, 1960

[fol. 6247] United States Department of Justice

Schedule IV

Arizona Public Service Company
P. O. Box 2591, Phoenix, Arizona

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No. However we will investigate use of aluminum underground cable and results of these studies may indicate that aluminum may become economical for underground use.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Do not use.

G. H. Foreman
Exec. Vice President
October 27, 1960

[fol. 6248] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Salt River Project Agricultural Improvement and Power District
P. O. Box 1980, Phoenix, Arizona**

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	646.27	103.28	8.24
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0.0	208.61	712.32
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,089,785	2,995,563	1,228,074
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	none	26,880	5,672,034
3. Copper wire and cable covered and insulated[3]	408,660	74,360	169,842
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	none	2,180,862	3,213,244

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. W. Brandow
Assistant General Manager
October 25, 1960

[fol. 6249] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Salt River Project Agricultural Improvement and Power District
P. O. Box 1980, Phoenix, Arizona

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	No Additions	21.8	24.7
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total; for all sizes, in thousands of feet of single conductor cable.. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. W. Brandow
Assistant General Manager
October 25, 1960

[fol. 6250] United States Department of Justice

Schedule III

Salt River Project Agricultural Improvement
and Power District
P. O. Box 1980, Phoenix, Arizona

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

1960-61 uses will be aluminum except for minor re-use of copper conductor presently existing in warehouse stock.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No. Arizona has no problems with salt water or chemical corrosion.

G. W. Brandow
Assistant General Manager
October 25, 1960

[fol. 6251] United States Department of Justice

Schedule IV

Salt River Project Agricultural Improvement
and Power District
P. O. Box 1980, Phoenix, Arizona

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Will continue to use copper cable except as stated in Item 'B' below.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We will continue to use copper cable in the 5 and 15 KV class due to size and economics. We may start using aluminum cable of the 600 volt class for distribution secondaries and services in residential subdivisions.

G. W. Brandow
Assistant General Manager
October 25, 1960

[fol. 6252] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Imperial Irrigation District
Imperial, California**

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	10.6	269.1	0
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	184.9	88.4	173.0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	127.2	1,538.6	1,123.0
3. Copper wire and cable covered and insulated[3]	339.8	375.5	319.6
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	418.8	1,620.8	795.5

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. F. Carter
General Manager
December 5, 1960

[fol. 6253] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Imperial Irrigation District
Imperial, California

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. F. Carter
General Manager
December 5, 1960

[fol. 6254] United States Department of Justice

Schedule III

Imperial Irrigation District
Imperial, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

R. F. Carter
General Manager
December 5, 1960

[fol. 6255] United States Department of Justice

Schedule IV

Imperial Irrigation District
Imperial, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

R. F. Carter
General Manager
December 5, 1960

[fol. 6256] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959[4]
Department of Water and Power

City of Los Angeles
Box 3669, Terminal Annex
Los Angeles 54, California

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines**	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	323.25
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	845	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,820	2,834	2,581
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	173	515
3. Copper wire and cable covered and insulated[3]	14,612	10,732	7,560
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	620	2,059

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] Fiscal Year Ending June 30 of Year Indicated.

** Transmission line construction by years is highly variable. In some years there will be no transmission lines built; in other years large transmission line projects will be constructed.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Ivan L. Bateman
Chief Electrical Engineer
and Assistant Manager
October 31, 1960

[fol. 6257] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959
Department of Water and Power

City of Los Angeles
Box 3669, Terminal Annex
Los Angeles 54, California

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	187	150
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,349	1,363	1,595
2. Aluminum & Aluminum Alloy	—	—	16

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Ivan L. Bateman
Chief Electrical Engineer
and Assistant Manager
October 31, 1960

[fol. 6258] United States Department of Justice

Schedule III

Department of Water and Power, City of Los Angeles
Box 3669 Terminal Annex, Los Angeles 54, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I

(overhead lines). If so, describe the changes indicating when they will occur.

The Department expects the use of copper for overhead distribution lines to stabilize at the present amount or at a slightly smaller amount. The use of aluminum should increase but at a lesser rate than the 1955-59 usage indicates.

The copper conductor for overhead transmission lines shown in 1958-59 was used in an area close to the ocean where severe corrosion problems exist. It is believed that in the future the Department of Water and Power will use little, if any, copper conductor in overhead transmission lines, assuming that the present differential in price between copper and aluminum continues.

In general new construction or replacement will be with aluminum, ACSR, or aluminum alloy conductors. Occasionally small quantities of copper may be used in relocating short sections of existing lines which have copper conductors.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

At present the Department uses aluminum for overhead distribution lines only in the San Fernando Valley north of Mulholland Drive. This territory is very dry. Its use is anticipated south of Mulholland Drive but we do not plan on using aluminum in the coastal area because of corrosion due to salt spray being carried inland by on-shore winds.

For overhead transmission lines to be located in close proximity to the ocean, aluminum would not be used due to severe corrosion problems encountered in such areas. In most cases, aluminum would be considered satisfactory if the distance from the ocean is more than two miles. It is not anticipated that the Depart-

ment of Water and Power will construct any overhead transmission lines in close proximity to the ocean in the near future.

Ivan L. Bateman
Chief Electrical Engineer
and Assistant Manager
October 31, 1960

[fol. 6259] United States Department of Justice

Schedule IV

Department of Water and Power, City of Los Angeles
Box 3669 Terminal Annex, Los Angeles 54, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Proportion of aluminum to copper usage will decrease to zero in 1960 and later years and will remain so until relative installed costs favor installation of aluminum.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductors is restricted to areas which are relatively free of ground water or other factors which may contribute to corrosion.

Ivan L. Bateman
Chief Electrical Engineer
and Assistant Manager
October 31, 1960

[fol. 6260] Pacific Gas and Electric Company
245 Market Street
San Francisco 6
SUtter 1-4211

Richard H. Peterson
General Counsel
F. T. Searls
General Attorney

November 17, 1960

Air Mail

Mr. Robert A. Bicks
Assistant Attorney General
Anti-Trust Division
U. S. Department of Justice
Washington, D. C.

Re: Your File RAB:CLW, 60-0-37-256

Dear Mr. Bicks:

Attached hereto are the schedules seeking information as to the relative use by electric utilities of aluminum and copper conductor which you forwarded to Mr. N. R. Sutherland with your letter of October 11, 1960. We have completed these schedules to the best of our ability and some comment on the information submitted is in order.

The quantities shown for the years 1950 and 1955 represent gross withdrawals and are not reduced by overdrawn quantities subsequently returned to storerooms for credit. They also include reusable copper conductor salvaged from plant retirements. During the year 1955 substantial quantities of bare and insulated copper wire used for overhead construction were reprocessed for Company use from copper wire salvaged in our own operations.

Due to the introduction of more modern accounting equipment after 1955 we were able to exclude from the totals on the attached schedules for the year 1959 overdrawn quantities subsequently returned to storerooms for credit. However, these totals do include reusable copper conductor salvaged from plant retirements.

Certain sizes of copper and aluminum conductors are used in distribution as well as transmission lines. Quantities of such conductors included for all years have been allocated [fol. 6261] between distribution and transmission on the basis of the best available information.

In obtaining the desired information from our records it was not possible, without referring to each requisition, to determine the quantities used for maintenance purposes and therefore the quantities reported by us on the attached schedules include conductor used for this purpose. However, such quantities are negligible in comparison to the totals.

Very truly yours, Richard H. Peterson.

PAC:TC.
Enclosures

[fol. 6262] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pacific Gas and Electric Company
245 Market Street
San Francisco 6, California

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	228.2	1[illegible]2	137.4
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,965.0	1,937.3	4,029.3
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	34,200.5	34,899.0	6,801.9
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	15,247.7	18,822.0	41,708.3
3. Copper wire and cable covered and insulated[3]	33,072.1	26,200.9	3,398.1
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	2,237.5	21,847.0

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[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

L. W. Coughlan
Comptroller
November 17, 1960

[fol. 6263] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pacific Gas and Electric Company
245 Market Street
San Francisco 6, California

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	.1	—	4.2
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,301.1	1,229.8	758.1
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

L. W. Coughlan
Comptroller
November 17, 1960

[fol. 6264] United States Department of Justice

Schedule III

Pacific Gas and Electric Company
245 Market Street
San Francisco 6, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No changes expected.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum conductor is not used for any distribution lines in a narrow coastal zone (averaging approximately ½ mile in width) because of possible corrosion of conductors and connections.

Aluminum conductor is not used for primary distribution circuits (except express sections of large conductor) in a broader coastal zone because of possible connection troubles from corrosion.

Use of aluminum conductor for transmission lines is not restricted because relatively large conductors and few connections minimize risk of corrosion trouble.

John F. Bonner
Vice President in Chg. of Engineering
November 17, 1960

[fol. 6265] United States Department of Justice

Schedule IV

Pacific Gas and Electric Company
245 Market Street
San Francisco 6, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No changes expected.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum conductor is not used for underground cables because savings in first cost of installations are marginal and do not justify risks of corrosion, connector troubles, etc.

John F. Bonner
Vice President in Chg. of Engineering
November 17, 1960

[fol. 6266] City of Pasadena
Light and Power Department

November 22, 1960.

United States Department of Justice
Washington, D. C.
Attention Robert A. Bicks,
Assistant Attorney General
Antitrust Division

Gentlemen:

RAB:CLW 60-0-37-256

The amount of electrical conductor used by us as shown under each category on the questionnaire as sent us is in feet as you surmized and not in thousands of feet as requested. We have placed the decimal point in the proper place on the copies sent us. The corrected copy is attached. Thank you for calling this to our attention.

In answer to your second question, the total amount of conductor shown under Item B-1, Schedule I is for grounds. We do not use bare copper wire in our system except for voltages of 15,000 volts or higher, and even here the only bare copper we have was installed several years ago. Our present practice calls for the installation of aluminum at these higher voltages where bare wire is required.

We are sorry that the correct answers were not given originally. If further information is desired do not hesitate to contact us.

Very truly yours, T. M. Goodrich, General Manager and Chief Engineer, Municipal Light and Power Department

AWC:rp
Encl.

Live Better . . . Electrically.

[fol. 6267] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pasadena Municipal Light & Power Department
100 North Garfield, Pasadena, California

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	34.317	.654
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare (Grounds)			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	0
3. Copper wire and cable covered and insulated[3]	1,044.666	633.252	118.523
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	23.623	503.703

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

All changes and corrections on Schedules I & II were made by the City of Pasadena.

Ellery R. Fosdick

T. M. Goodrich
General Manager and Chief Engineer
Municipal Light and Power Department
October 26, 1960

[fol. 6268] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Pasadena Municipal Light & Power Department
100 North Garfield, Pasadena, California

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	34.846	.113
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	211.467	481.289	323.085
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

T. M. Goodrich
General Manager and Chief Engineer
October 26, 1960

[fol. 6269] United States Department of Justice

Schedule III

Pasadena Municipal Light and Power Department
100 North Garfield, Pasadena, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Our policy is to use aluminum conductors for overhead lines except for transformer tops and ground wires. We also use copper for repairing of and small extensions to existing copper lines. The use of copper should show a slight proportional decrease through the coming years as more existing lines are replaced.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not limit or restrict the use of aluminum conductors for overhead lines.

T. M. Goodrich
General Manager and Chief Engineer
October 26, 1960

[fol. 6270] United States Department of Justice

Schedule IV

Pasadena Municipal Light and Power Department
100 North Garfield, Pasadena, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We do not use aluminum for underground cables and do not contemplate any change in the near future.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We restrict the use of aluminum conductors in underground cable because of space, size of existing ducts, and difficulties in splicing.

T. M. Goodrich
General Manager and Chief Engineer
October 26, 1960

[fol. 6271] Southern California Edison Company
Edison Building, P.O. Box 351
Los Angeles 53, California

Law Department

January 13, 1961.

Our File No. A-5790

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Karp

Gentlemen:

Your Reference: RAB:CLW, 60-0-37-256.

Supplementing my earlier letter of January 6, 1961, there is transmitted herewith the statistical information which you requested from our Company by your letter of December 23, 1960.

Very truly yours, Rollin E. Woodbury, General Counsel.

REW:co
Enclosures

[fol. 6272] United States Department of Justice

Schedule I.

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern California Edison Company
601 West Fifth Street, Los Angeles, California

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,920	30	41
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,893	2,039	5,057
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	29,568	9,904	6,610
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	19,042	23,112
3. Copper wire and cable covered and insulated[3]	37,380	11,983	4,712
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	29,817	25,731

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. E. Montgomery
Vice President
January 13, 1961

[fol. 6273] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern California Edison Company
601 West Fifth Street, Los Angeles, California

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1,340	1,656	1,483
2. Aluminum & Aluminum Alloy	0	0	723

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. E. Montgomery
Vice President
January 13, 1961

[fol. 6274] United States Department of Justice

Schedule III

Southern California Edison Company
601 West Fifth Street, Los Angeles, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We do not presently anticipate any significant increase or decrease in the near future in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines)

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not restrict or limit the use of aluminum conductors on overhead high voltage transmission lines, including lines in coastal areas. However, distribution lines within one mile of contaminated coastal areas have been constructed of copper conductors.

We also have used copper conductors for all connections to the terminals of line equipment or apparatus, (i.e., transformers, switches, reclosers, etc.). It has been our experience that while some equipment terminals are suitable for aluminum conductors, others have been unsatisfactory. To maintain standard construction practices by our field forces, copper conductor is used for all such connections.

W. E. Montgomery
Vice President
January 13, 1961

[fol. 6275] United States Department of Justice

Schedule IV

Southern California Edison Company
601 West Fifth Street, Los Angeles, California

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Changes are expected to be made only to the extent that the total installed costs of aluminum and copper change. We expect to use aluminum and copper interchangeably on the basis of least costs, giving due recognition to material costs, installation costs, electrical losses, reliability and permanency. Changes from one to the other will not be made on a day to day, or other short time, basis.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Restrictions in the use of aluminum may occur in some instances because of insufficient duct size in existing facilities. The extra cost of increased duct size in new facilities, due to the use of aluminum, is recognized as an added cost to the aluminum conductors.

To date, we have found no other reasons, other than those stated above, to limit the use of aluminum; however, we expect to be guided by operating experience.

W. E. Montgomery
Vice President
January 13, 1961

[fol. 6276] Southern California Edison Company
Edison Building, P.O. Box 351
Los Angeles 53, California

Law Department

January 6, 1961.

Our File No. A-5790

Air Mail

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Karp

Gentlemen:

Your Reference: RAB:CLW, 60-0-37-256

As a result of your letter of December 23, 1960 and our recent telephone conversation, wherein you indicated that the information in the Federal Power Commission reports did not fully serve your purposes and requesting that we furnish information as indicated on the schedules transmitted with your letter relative to our Company's use of certain overhead and underground conductors, I have requested, since the information desired is statistical, the affected departments of our Company to provide the statistical information requested to the extent that such information can be supplied from our Company's books and records.

I inquired of such departments as to the time that they estimated would be required to collect the data, and was advised that such time would be a week or ten days. As soon as it has been collected, I will transmit it to you.

Yours very truly, Rollin E. Woodbury, General Counsel.

REW:eb

[fol. 6277] Southern California Edison Company
Edison Building, P.O. Box 351
Los Angeles 53, California
Law Department

October 18, 1960.

Our File No. A-4593-M

United States Department of Justice
Washington, D. C.
Attention: Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division

Dear Mr. Bicks:

Re: Your File RAB:CLW, 60-0-37-256

Your letter of October 11, 1960, addressed to Mr. Horton and bearing the above reference number, has been referred to me for reply.

As indicated in your earlier correspondence with Mr. Marx of our legal department, you were previously advised that our Company has consistently taken the position, in connection with inquiries for information from its files involved in litigation in which it was not a party, to request that such information be obtained where appropriate through subpoena; this position has been predicated upon our Company's desire to be neutral and impartial in connection with any litigation in which it is not a party.

In connection with your most recent request, it appears that certain of the information which you desire is reflected in portions of the public reports which are filed by our Company and other utilities with the Federal Power Commission in Washington, D. C. I am advised that the Federal Power Commission Form 1 for Class A and B electric utilities and licenses includes a statistical report on transmission lines added during the year, being reported in the section dealing with transmission line statistics, and that similar information may be derived from statistics in a somewhat different form which appear in Federal Power Com-

mission Form 12 also filed with the Federal Power Com-
[fol. 6278] mission in Schedule 18-A. Since we are not fully apprised as to your purposes in connection with this inquiry, I am of course not certain that the above-mentioned statistical information will be satisfactory to you, but I am calling it to your attention in the hopes that it may be helpful.

Sincerely yours, Rollin E. Woodbury, General Counsel.

REW:eb

[fol. 6279] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Mountain View Electric Association, Inc.
Limon, Colorado

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	2,000
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,471	223	217
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,012	237	240
3. Copper wire and cable covered and insulated[3]	27	63	17
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	11	12

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

A. C. Payne
Assistant Manager
October 26, 1960

[fol. 6280] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Mountain View Electric Association, Inc.
Limon, Colorado

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

A. C. Payne
Assistant Manager
October 26, 1960

[fol. 6281] United States Department of Justice

Schedule III

Mountain View Electric Association, Inc.
Limon, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

There will be approximately 70% more aluminum used than copper.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

A. C. Payne
Assistant Manager
October 26, 1960

[fol. 6282] United States Department of Justice

Schedule IV

Mountain View Electric Association, Inc.
Limon, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No Underground.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

A. C. Payne
Assistant Manager
October 26, 1960

[fol. 6283] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of Colorado
900 15th Street, Denver, Colorado

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959[4]
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	20	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	502	1,591
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,357	2,520	453
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	232	4,471	4,984
3. Copper wire and cable covered and insulated[3]	4,583	2,645	643
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	2,651	4,875

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

[4] These figures are partially estimated as the records are not completely closed for this year's work.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. D. Winters
Executive Vice-President
October 31, 1960

[fol. 6284] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of Colorado
900 15th Street, Denver, Colorado

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959[3]
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	28	85	85
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

[3] These figures are partially estimated as the records are not completely closed for this year's work.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. D. Winters
Executive Vice-President
October 31, 1960

[fol. 6285] United States Department of Justice

Schedule III

Public Service Company of Colorado
900 15th Street, Denver, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change from 1959.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

W. D. Winters
Executive Vice-President
October 31, 1960

[fol. 6285a] United States Department of Justice

Schedule IV

Public Service Company of Colorado
900 15th Street, Denver, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

It is considered that aluminum cable has not been proven as a satisfactory conductor for underground use.

W. D. Winters
Executive Vice-President
October 31, 1960

[fol. 6286] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southeast Colorado Power Association
901 West Third Street
La Junta, Colorado

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare			
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			211
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare			25
2. Aluminum and aluminum alloy wire and cable-bare & ACSR			836
3. Copper wire and cable covered and insulated[3]			11
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]			119

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

James N. Myers
Manager
October 24, 1960

[fol. 6287] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southeast Colorado Power Association
901 West Third Street
La Junta, Colorado

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

James N. Myers
Manager
October 24, 1960

[Vol. 6288] United States Department of Justice

Schedule III

Southeast Colorado Power Association
901 West Third Street
La Junta, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We consider that the price of copper makes it too expensive for us to use. About 5 years ago we started eliminating the use of copper in all places possible. We will continue to reduce the use of copper in all places possible, although we are using proportionately about as small an amount of copper as we can.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Aluminum overhead conductor gives us no problems in our area. We find it more economical than copper and very satisfactory.

James N. Myers
Manager
October 24, 1960

[fol. 6289] United States Department of Justice

Schedule IV

Southeast Colorado Power Association
901 West Third Street
La Junta, Colorado

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Very small amounts of underground cable used.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

[No answer]

James N. Myers
Manager
October 24, 1960

[fol. 6290] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of New Mexico
Albuquerque, New Mexico

Type of Overhead Line	Ans[illegible] in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	10	256	2
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	191	1,707
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	73	558	73
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	9	1,294	1,924
3. Copper wire and cable covered and insulated[3]	2,772	1,645	50
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	9	2,159

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. R. Wells
Supervisor, Plant and Property Department
October 19, 1960

[fol. 6291] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of New Mexico
Albuquerque, New Mexico

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. A. Schreiber
Executive Vice President
October 21, 1960

[fol. 6292] United States Department of Justice

Schedule III

Public Service Company of New Mexico
Albuquerque, New Mexico

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

There will be little if any change in the proportion, unless there is a change in the economic relationship of Copper and Aluminum.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions in overhead lines.

G. A. Schreiber
Executive Vice President
October 21, 1960

[fol. 6293] United States Department of Justice

Schedule IV

Public Service Company of New Mexico
Albuquerque, New Mexico

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

There may be a slight tendency toward Aluminum in insulated underground cables.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Direct burial bare conductor for grounding is limited to copper, mainly because of the alkaline conditions of the soil.

G. A. Schreiber
Executive Vice President
October 21, 1960

[fol. 6294] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern Nevada Power Co.
Las Vegas, Nevada

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	71	16	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	303	195
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	See Note		136
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	See Note		636
3. Copper wire and cable covered and insulated[3]	See Note		176
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	See Note		670

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note—Complete information on distribution lines not available for years 1950 and 1955. No aluminum conductor installed in distribution lines in 1950.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harry Allen
Vice President
October 27, 1960

[fol. 6295] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern Nevada Power Co.
Las Vegas, Nevada

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harry Allen
Vice President
October 27, 1960

[fol. 6296] United States Department of Justice

Schedule III

Southern Nevada Power Co.
Las Vegas, Nevada

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Harry Allen
Vice President
October 27, 1960

[fol. 6297] United States Department of Justice

Schedule IV

Southern Nevada Power Co.
Las Vegas, Nevada

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Harry Allen
Vice President
October 27, 1960

[fol. 6298] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Utah Power & Light Company
1407 West North Temple Street
P. O. Box 899
Salt Lake City 10, Utah

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	236	1	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	362	4604	4814
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3457	4156	1654
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	3049	6011
3. Copper wire and cable covered and insulated[3]	3093	1270	275
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	1504	3280

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Paul A. Blanchard
Vice President
October 28, 1960

[fol. 6299] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Utah Power & Light Company
1407 West North Temple Street
P. O. Box 899
Salt Lake City 10, Utah

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	10	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	19	100	63
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Paul A. Blanchard
Vice President
October 28, 1960

[fol. 6300] United States Department of Justice

Schedule III

Utah Power & Light Company
1407 West North Temple Street
P. O. Box 899
Salt Lake City 10, Utah

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Paul A. Blanchard
Vice President
October 28, 1960

[fol. 6301] United States Department of Justice

Schedule IV

Utah Power & Light Company
1407 West North Temple Street
P. O. Box 899
Salt Lake City 10, Utah

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The use of aluminum conductor for underground cables has been restricted because of size and cost of installation, particularly in existing ducts.

Paul A. Blanchard
Vice President
October 28, 1960

[fol. 6302] Utilities

Region: VI South Central

State	Name
Arkansas	Arkansas Power & Light Co.
Arkansas	Craighead Electric Coop. Corp.
Louisiana	Louisiana Power & Light Co.
Louisiana	New Orleans Public Service, Inc.
Oklahoma	Oklahoma Gas & Electric Co.
Oklahoma	Public Service Co. of Oklahoma
Texas	City Public Service Board—San Antonio
Texas	Houston Lighting & Power Co.
Texas	Lower Colorado River Electric Coop. Inc.

[fol. 6303] Arkansas Power & Light Company
Helping Build Arkansas
Pine Bluff, Arkansas

November 4, 1960.

RAB:CLW 60-0-37-256

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

In accordance with your letter dated October 11, 1960, to Arkansas Power & Light Company we are attaching completed schedules showing the related use of aluminum and copper conductor by this company.

Very truly yours, W. M. Harrell, Treasurer.

WMH/rg,
Attach.

[fol. 6304] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Arkansas Power & Light Company
Pine Bluff, Arkansas
(See Note A)

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1253	847	395
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	16203	3355	5324
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	7907	6318
3. Copper wire and cable covered and insulated[3]	1664	1503	633
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	None	5669

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note A—See letter of transmittal dated November 4, 1960 for basis of compiling data.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. M. Harrell
Treasurer
November 4, 1960

[fol. 6305] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Arkansas Power & Light Company
Pine Bluff, Arkansas
(See Note A)

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	61	49	15
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

Note A—See letter of transmittal dated November 4, 1960 for basis of compiling data.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. M. Harrell
Treasurer
November 4, 1960

[fol. 6306] United States Department of Justice

Schedule III

Arkansas Power & Light Company
Pine Bluff, Arkansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Any proportionate change in the use of aluminum to copper used in any classification of Schedule I (overhead lines) will be determined on price differential at the time of purchase.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

W. M. Harrell
Treasurer
November 4, 1960

[fol. 6307] United States Department of Justice

Schedule IV

Arkansas Power & Light Company
Pine Bluff, Arkansas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Any proportionate change in the use of aluminum to copper used in any classification of Schedule II (underground cables) will be determined on price differential at the time of purchase.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

On existing systems restrictions on the use of aluminum cables for replacement purposes would be attributable to space limitations and size of the existing ducts. On proposed extensions or expansions the use of aluminum cabies presently would be restricted due to lack of experience with aluminum cables in underground distribution systems. Also, there is presently no economic advantage in the use of aluminum cables in lieu of copper cables.

W. M. Harrell
Treasurer
November 4, 1960

[fol. 6308] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Craighead Electric Coop. Corp.
Jonesboro, Ark.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	0
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	193	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	220	37	53
3. Copper wire and cable covered and insulated[3]	433	238	0
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	54	246

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Dale Reaves
Purchasing Agent
October 14, 1960

[fol. 6309] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Craighead Electric Coop. Corp.
Jonesboro, Ark.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0

---

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Dale Reaves
Purchasing Agent
October 14, 1960

[fol. 6310] United States Department of Justice

Schedule III

Craighead Electric Coop. Corp.
Jonesboro, Ark.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We expect to use all aluminum for all new construction, both primary and services. Some copper will be used for replacement of small sizes of copper.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions except we do not string aluminum under copper.

Dale Reaves
Purchasing Agent
October 14, 1960

[fol. 6311] United States Department of Justice

Schedule IV

Craighead Electric Coop. Corp.
Jonesboro, Ark.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No experience with underground cable.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Dale Reaves
Purchasing Agent
October 14, 1960

[fol. 6312] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Louisiana Power & Light Company
142 Delaronde Street
New Orleans 14, Louisiana

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1	1	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,230	931	581
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	6,062	2,842	636
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	7,831	9,256	10,027
3. Copper wire and cable covered and insulated[3]	5,068	654	86
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	89	3,262	4,711

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note: Wire and cable purchased in feet and pounds. The wire purchased in pounds was converted to feet by using conversion tables from manufacturer's catalogue.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. C. Rawls
President
October 27, 1960

[fol. 6313] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Louisiana Power & Light Company
142 Delaronde Street
New Orleans 14, Louisiana

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	12
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	4	28	1
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

G. C. Rawls
President
October 27, 1960

[fol. 6314] United States Department of Justice

Schedule III

Louisiana Power & Light Company
142 Delaronde Street
New Orleans 14, Louisiana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No significant change expected in 1960. The Company purchases its transmission and distribution conductor on the basis of its dollars buying the most electrical conductivity. Hence price relationships would determine the conductor purchased.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do not use aluminum conductor within three miles of the Gulf of Mexico.

G. C. Rawls
President
October 27, 1960

[fol. 6315] United States Department of Justice

Schedule IV

Louisiana Power & Light Company
142 Delaronde Street
New Orleans 14, Louisiana

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No significant change expected in 1960. The Company purchases its transmission and distribution conductor on the basis of its dollars buying the most electrical conductivity. Hence price relationships would determine the conductor purchased.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Company does not use aluminum conductor in underground cable installations due to misgivings concerning chemical reactions.

G. C. Rawls
President
October 27, 1960

[fol. 6316] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**New Orleans Public Service Inc.
317 Baronne St., New Orleans, La.**

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	—	21	18
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	—	31
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,008	1,389	61
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	51	875
3. Copper wire and cable covered and insulated[3]	1,182	1,354	33
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	—	2,329

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

——— ———,
Executive Vice President
October 24, 1960.

[fol. 6317] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

New Orleans Public Service Inc.
317 Baronne St., New Orleans, La.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	75	382	131
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

—— ——,
Executive Vice President
October 24, 1960

[fol. 6318] United States Department of Justice

Schedule III

New Orleans Public Service Inc.
317 Baronne St., New Orleans, La.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No appreciable increase or decrease in proportion of aluminum to copper for overhead conductors is anticipated.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions or limits for use of aluminum conductors for overhead construction.

——— ———,
Executive Vice President
October 24, 1960

[fol. 6319] United States Department of Justice

Schedule IV

New Orleans Public Service Inc.
317 Baronne St., New Orleans, La.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No appreciable increase or decrease in proportion of aluminum to copper for underground conductors is anticipated.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Copper is used exclusively in our underground installations for: 1. Existing duct size limitations: 2. Ease of splicing in vaults, and manholes.

——— ———,
Executive Vice President
October 24, 1960

[fol. 6320] Oklahoma Gas & Electric Company
321 North Harvey
Oklahoma City 1, Okla.
Phone CE 2-3366
Post Office Box 1498

November 29, 1960.

Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Robert A. Bicks, Assistant Attorney General
Your Reference: RAB-CLW, 60-0-36-256

Dear Sir:

In accordance with instruction from Mr. Samuel Karp of the Department of Justice, we have converted pounds to feet on our aluminum and copper conductors for the years, 1950, 1955 and 1959, which is in response to your letter dated October 11, 1960 and in further connection with our letter to you October 26, 1960.

The attachments to your schedules show the trends in the use of copper and aluminum conductors in our Company and the method of conversion we have used in arriving at the footage of these conductors.

Yours very truly, H. H. Ferrin, Vice President and Treasurer.

HHF/em
encls.

[fol. 6321] Oklahoma Gas & Electric Company
321 North Harvey
Oklahoma City 1, Okla.

October 26, 1960.

Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Robert A. Bicks, Assistant Attorney General

Your Reference: RAB-CLW, 60-0-36-256

Dear Sir:

This letter is in response to your letter dated October 11, 1960, stating that the Department of Justice is seeking information as to the relative use by electric utilities of aluminum and copper conductor for new construction and for replacement.

With your letter were forms of schedules to be completed showing additions in our system of quantities in thousands of feet of transmission line copper wire and cable-bare and of aluminum and aluminum alloy wire. The schedule also requires an answer in thousands of feet of distribution line electrical conductor (with certain exceptions) in 4 categories in thousands of feet for each of the years 1950, 1955, 1959.

The second page of the schedules requires an estimate as to any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification. This page also calls for a statement as to limitations or restrictions on use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals.

Your letter requires an answer by October 31, 1960, with an affirmation of verity. We have given every serious consideration to responding to your request despite the problems involved in correctly stating the information you seek from us. The information requested is not available in the required detail from our Plant Accounting Records. Conductor accounts are not stated in our accounts in feet. We do not segregate bare and covered conductor in the distribution accounts.

[fol. 6322] To comply with your request with the degree of accuracy which we believe would be necessary to fulfill your requirements for exactitude would take a great deal of time and research into original individual job orders and stores requisitions dating back to 10 years. It would be impossible to comply within the time limit stated by you and it would by impraticable to estimate any period of time within which we could complete the research necessary to respond truthfully within the terms of the affirmation you prescribe.

Yours truly, Oklahoma Gas and Electric Co., By H. H. Ferrin, Vice President and Treasurer.

HHF*pw

[fol. 6323] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Oklahoma Gas and Electric Company
321 N. Harvey, Oklahoma City, Okla.

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	321	68	23
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	4,069	1,269	1,725
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable–bare and insulated	1,943	1,369	2,201
2. Aluminum and aluminum alloy wire and cable–bare & ACSR and insulated	5,787	7,118	7,734
3. Copper wire and cable covered and insulated[3]*			
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]*			

* Not available.

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all size , in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. H. Ferrin
Vice President and Treasurer
November 29, 1960

[fol. 6324] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Oklahoma Gas and Electric Company
321 N. Harvey, Oklahoma City, Okla.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	3	28	90
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

H. H. Ferrin
Vice President and Treasurer
November 29, 1960

[fol. 6325] United States Department of Justice

Schedule III

Oklahoma Gas and Electric Company
321 N. Harvey—Oklahoma City, Oklahoma

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

See attached statement.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

See attached statement.

H. H. Ferrin
Vice President and Treasurer
November 29, 1960

[fol. 6326] United States Department of Justice

Schedule IV

Oklahoma Gas and Electric Company
321 N. Harvey—Oklahoma City, Oklahoma

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

See attached statement.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

See attached statement.

H. H. Ferrin
Vice President and Treasurer
November 29, 1960

[fol. 6327] Trends in the Use of Copper and

Aluminum Conductors

The Past. Prior to about 1926, Oklahoma Gas and Electric Company used copper exclusively for all normal transmission and distribution purposes.

The long term trend since then has been toward aluminum, first on transmission, then on rural lines, then on urban distribution systems, until today this metal is used for all transmission and nearly all overhead distribution purposes. Copper is used for underground and for a few special overhead applications.

The Future. We see nothing, except change in the relative price of the two metals, which would cause our Company to go back to copper on any large scale basis. We have no salt or contaminated atmosphere of consequence in our service area in Oklahoma and Arkansas. More trouble is experienced with connections to aluminum than to copper conductors but not enough to change the relative economics. Both metals are good electrical conductors. Copper is the better conductor on volume (circular mil) basis; aluminum is the better conductor on the basis of equal weight.

If underground systems in residential areas should grow in popularity, there is a strong possibility that our Company would use aluminum extensively, especially for the direct burial portions.

Transmission. Since 1946, all transmission lines have been constructed of acsr (Aluminum Conductor Steel Reinforced), except where old conductor was reused. Between 1926 and 1946 both copper and acsr were used according to price differential and other factors.

Rural Lines. Between the late 1920's and the late 1930's both copper and acsr were used in rural areas. Since then, acsr has been used almost exclusively.

Urban Distribution. Copper was used exclusively until 1947. Since then aluminum, with and without steel reinforcing, has been used almost exclusively for all overhead purposes including primary, secondary and service drops.

Coverings on Conductors. About 1930, our Company ceased the use of coverings on all overhead conductors except for service drops and a few special situations.

[fol. 6328] Method of Conversion from Pounds to Feet

Overhead Lines

A. Transmission

Pounds of copper and pounds of aluminum conductor converted from pounds to feet for each job order on the basis of the size of conductor installed on each order.

B. Distribution

Total pounds of copper and pounds of aluminum conductor installed converted to feet on the basis of an average conversion ratio.

An average conversion ratio was calculated from total pounds for each size of conductor issued from stores during 1959 and resulting footage for each size to obtain an average feet per pound for all issues from stores.

This average was used to convert number of pounds of conductor installed in distribution plant number of feet.

The average for 1959 with changes for known variations was used to convert 1950 and 1955.

Underground Cable

Actual footage of underground cable is shown for the periods reported.

[fol. 6329] Public Service Company of Oklahoma
General Offices, P.O. Box 201
Tulsa 2, Oklahoma

December 12, 1960.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Re: RAB:CLW, 60-0-37-256

Dear Mr. Bicks:

Following out the telephone conversation which I had last month with Mr. Samuel Karp of your staff, I am enclosing herewith our schedules concerning the relative use of aluminum and copper conductor.

We found we could not accomplish our objectives by going on the basis of engineering estimates so, we put on a night staff and accomplished your request by analysis of our book records which I believe to be substantially correct.

Yours very truly, Elmer K. Higley, Controller.

EKH:cy
cc: DJTuepker, RONewman
Enclosures

The Electric Power of Oklahoma's Progress for Nearly 50 Years.

[fol. 6330] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of Oklahoma
Tulsa, Oklahoma

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	30	1	3
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	359	1,749	1,799
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	1,359	1,282	392
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,003	4,444	3,108
3. Copper wire and cable covered and insulated[3]	5,655	7,714	766
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	2	310	3,521

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Elmer K. Higley
Controller
December 12, 1960

[fol. 6331] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Public Service Company of Oklahoma
Tulsa, Oklahoma

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—0—	—0—	—0—
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	60	60	20
2. Aluminum & Aluminum Alloy	—0—	—0—	—0—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Elmer K. Higley
Controller
December 12, 1960

[fol. 6332] United States Department of Justice

Schedule III

Public Service Company of Oklahoma
Tulsa, Oklahoma

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Only a slight increase in proportion of aluminum to copper over 1959 ratio.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No corrosion or chemical restrictions on overhead conductors.

Elmer K. Higley
Controller
December 12, 1960

[fol. 6333] United States Department of Justice

Schedule IV

Public Service Company of Oklahoma
Tulsa, Oklahoma

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No.

Elmer K. Higley
Controller
December 12, 1960

[fol. 6334] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

City Public Service Board
Navarro at Villita Street, San Antonio, Texas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	8.2	3.4	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	610.7	61.0	189.8
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	3,072.4	276.2	739.6
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	930.7	3,513.7	2,304.3
3. Copper wire and cable covered and insulated[3]	206.1	166.7	41.4
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	.1	3,781.0	4,903.3

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold Tynan
Manager Electric System
October 25, 1960

[fol. 6335] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

City Public Service Board
Navarro at Villita Street, San Antonio, Texas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	—	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	45.2	62.9	13.7
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Harold Tynan
Manager Electric System
October 25, 1960

[fol. 6336] United States Department of Justice

Schedule III

City Public Service Board
Navarro at Villita Street - San Antonio, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

1. For 1960, there should not be any substantial increase (with no decrease) in the use of Al. or Cu. in this system.

2. A considerable increase in the use of aluminum by this Utility is planned for the years 1961, 1962 and 1963, particularly in *transmission lines,* as indicated below: (Thousands of feet)

1961	1962	1963
10,058.4 ft.	39,093.1 ft.	58,085.2 ft.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Harold Tynan
Manager Electric System
October 25, 1960

[fol. 6337] United States Department of Justice

Schedule IV

City Public Service Board
Navarro at Villita Street - San Antonio, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of alumimum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No plans at present to change proportions.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The City Public Service Board's use of aluminum conductor for underground cables is restricted because of cold flow of the conductor in terminating.

Harold Tynan
Manager Electric System
October 25, 1960

[fol. 6338] Houston Lighting & Power Company
Electric Building, Houston 1, Texas

October 27, 1960.

Mr. Robert A. Bicks, Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Your Reference No.: RAB-CLW, 60-0-37-256

Dear Mr. Bicks:

In accordance with the request made in your letter of October 11, 1960 to Mr. T. H. Wharton, we have assembled certain information concerning our use of copper and aluminum conductors. The schedules which accompanied your letter have been completed and are being returned to you herewith.

We wish to point out that the quantities in Schedule I-B are approximate, for the following reason. Our records are kept by groups of sizes rather than by individual specific sizes of conductors; also our records are kept in pounds rather than in feet. Therefore to convert from pounds of conductor of assorted sizes to feet of conductor, we have had to use our best judgment and choose one size for each group which, in our opinion, would represent the weighted average of the group. Pounds of this size were then converted to feet to get the answers in the units which you requested. However we believe that this procedure gives a reasonably accurate final figure in feet.

We trust that the information here supplied will be satisfactory.

Yours very truly,
J. F. Estill, Jr., Vice President.

JFE/bw
encl.

[fol. 6339] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Houston Lighting & Power Co.
Electric Building, Houston 1, Texas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	281	23	9
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	487	1,286	2,152
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	6,506	1,468	1,537
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	760	5,593	8,469
3. Copper wire and cable covered and insulated[3]	6,743	1,511	796
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	—	8,405	7,090

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

J. F. Estill, Jr.
Vice President
October 27, 1960

[fol. 6340] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Houston Lighting & Power Co.
Electric Building, Houston 1, Texas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	383	887	936
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

J. F. Estill, Jr.
Vice President
October 27, 1960

[fol. 6341] United States Department of Justice

Schedule III

Houston Lighting & Power Co.
Electric Building
Houston 1, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

The proportion of aluminum and copper used will depend on the relative prices and the relative availability of the two metals. Since we can not predict these factors with any degree of accuracy, we do not feel that we should make statements as to the future use of copper and aluminum relative to each other.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

In very limited areas around certain chemical plants and in a very narrowly defined area adjacent to the gulf coast we restrict the use of aluminum. In these areas copper is used because it gives greater resistance to the corrosive effort ef certain chemicals in the atmosphere and to salt spray.

J. F. Estill, Jr.
Vice President
October 27, 1960

[fol. 6342] United States Department of Justice

Schedule IV

Houston Lighting & Power Co.
Electric Building
Houston 1, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

At present we use copper for underground cables. We expect no change in that practice in 1960.
The use of aluminum in underground cables will continue to be given thought and study, but we do not feel that we can make a prediction as to when, if ever, our present practice will change. However, as aluminum cable could not be used in the present duct system, we do not expect any drastic change in the proportion of copper to aluminum in the next few years.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We do restrict the use of aluminum conductor for underground cable to the extent of using no aluminum; in other words copper is used altogether in this area. The reason for our taking this position is two-fold:

1. We believe that the cost of the duct and cable system is less for copper than for aluminum.
2. In our opinion, a more satisfactory splicing job can be done with copper than with aluminum.

J. F. Estill, Jr.
Vice President
October 27, 1960

[fol. 6343] Pedernales Lower Colorado River
Electric Cooperative
"Texas Corporations"
P. O. Box 1153
Austin 63, Texas

December 6, 1960

Robert A. Bicks
Assistant Attorney General
Antitrust Division
U. S. Department of Justice
Washington, D. C.

Re: RAB; CLW 60-0-37-256

Dear Mr. Bicks:

Attached please find questionnaires for the Pedernales Electric Cooperative, Inc. and the Lower Colorado River Electric Cooperative, Inc. giving schedules of conductors used for the years 1950, 1955, and 1959. The amount of conductors shown on the attached schedules was arrived at by past purchases for the two above mentioned Cooperative's. The amount shown on these schedules is the amount that was purchased during these years except in the case of the Pedernales Electric Cooperative for the year 1950.

In 1950 the Pedernales Electric Cooperative did not purchase any conductor other than covered copper conductor and cables. This conductor was used for service drops. Therefore, we checked the purchases for 1949, assuming that a portion of this wire was used in 1950.

According to our records, the Pedernales Electric Cooperative constructed 109 miles of line in the year of 1950. This includes all types of lines constructed.

If we can be of further assistance, please call us.

Very truly yours, M. G. Hyltin, General Manager

MGH:DM:mc
Attachments

[fol. 6344] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Lower Colorado River Electric Cooperative, Inc.
Giddings, Texas

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Amerductor Wire ***	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	596.1	1,369.0	584.8
3. Copper wire and cable covered and insulated[3]	265.1	59.5	12.6
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	None	26.0	147.5

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

*** This conductor is composed of galvanized steel conductors and copper conductors stranded together.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. G. Hyltin
General Manager
December 6, 1960

[fol. 6345] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Lower Colorado River Electric Cooperative, Inc.
Giddings, Texas

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

M. G. Hyltin
General Manager
December 6, 1960

[fol. 6346] United States Department of Justice

Schedule III

Lower Colorado River Electric Cooperative, Inc.
Giddings, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

We do not expect any substantial increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I. We have found that ACSR conductors in most cases are more economical to use than copper or copperweld conductors. This economy is brought about mainly by the light weight of aluminum conductors for any given current carrying capacity. In recent years, we have adopted the practice of using ACSR and or aluminum triplex and quadriplex cables for service wire due to the greater economy of using aluminum.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

We have experienced no problems in this area because of corrosion by salt water and chemicals and for these reasons we expect to continue use of ACSR in constructing lines.

M. G. Hyltin
General Manager
December 6, 1960

[fol. 6347] United States Department of Justice

Schedule IV

Lower Colorado River Electric Cooperative, Inc.
Giddings, Texas

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

This Cooperative does not employ use of underground cables for purposes of serving our members.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

This Cooperative does not employ use of underground cables for purposes of serving our members.

M. G. Hyltin
General Manager
December 6, 1960

[fol. 6348] Utilities

Region: VII Southeastern

State	Name
Alabama	Alabama Power Co.
Florida	Clay Electric Coop. Inc.
Florida	Florida Power and Light Co.
Georgia	Georgia Power Co.
Mississippi	Mississippi Power & Light Co.
Mississippi	Southern Pine Electric Power Assn.
North Carolina	Carolina Power & Light Co.
North Carolina	Duke Power Co.
South Carolina	South Carolina Electric & Gas Co.
South Carolina	South Carolina Public Service Authority
Tennessee	Kingsport Utilities, Inc.
Tennessee	Memphis Light Gas & Water Division

[fol. 6349] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Alabama Power Company
600 N. 18th Street, Birmingham, Alabama

Type of Overhead Line	[2]Answer in Thousands of Feet[2] 1950	1955	1959.
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	139.7	134.0	—
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,136.9	1,215.4	6,646.8
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	3,916.56	3,141.27	1,087.23
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	23,158.77	14,465.58	13,247.63
3. Copper wire and cable covered and insulated[3]	9,271.15	8,262.85	5,041.95
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	32.89	3,254.86	12,720.69

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note: The quantities reported above are in feet of wire of all sizes installed as phase or neutral conductors in gross additions and replacements to the transmission and distribution systems and consist of both newly acquired and reusable materials.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. L. Harris
Vice President–Electric Operations
November 7, 1960

[fol. 6350] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Alabama Power Company
600 N. 18th Street, Birmingham, Alabama

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	—	14.6	—
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	141.02	50.60	32.98
2. Aluminum & Aluminum Alloy	—	.28	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

Note: The quantities reported above are in feet of wire of all sizes installed as phase or neutral conductors in gross additions and replacements to the transmission and distribution systems and consist of both newly acquired and reusable materials.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. L. Harris
Vice President–Electric Operations
November 7, 1960

[fol. 6351] United States Department of Justice

Schedule III

Alabama Power Company
600 N. 18th Street, Birmingham, Alabama

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

In all cases, the choice between use of aluminum conductor and copper conductor is influenced to a material extent by economics, i.e. by comparative quoted delivered costs per 1,000 feet of the respective conductors at the time of need. Other factors considered in the choice are (1) the effect of sag comparative characteristics on installed costs; (2) the effect of relative physical size in high voltage transmission; (3) breaking strength required in comparison with relative breaking strength available in equivalent capacity conductors of small sizes of the respective materials; (4) local conditions in areas where installations are to be made; and (5) material of existing conductors where to be paralleled by additional conductors on the same poles.

It is our opinion that proportion of aluminum to copper will tend to continue to increase in all classifications of Schedule I but further changes will be gradual and cannot be timed.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No rigid restriction or limit has been specified for use of either copper or aluminum. In general but not

without exception copper has been and is continuing to be used where exposure to salt spray is moderate to severe. Where aluminum is used in such locations, precautions are observed in order to prevent or minimize corrosive action of the salt spray on aluminum and composite steel and aluminum conductors.

R. L. Harris
Vice President–Electric Operations
November 7, 1960

[fol. 6352] United States Department of Justice

Schedule IV

Alabama Power Company
600 N. 18th Street, Birmingham, Alabama

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Transmission lines have not heretofore been regularly installed underground. Such as have been so installed consist of relatively short lines or short extension lines added at irregular intervals during the last 15 years. No worthwhile opinions or conclusions relative to proportions of aluminum to copper in possible future installations can be drawn from projection of such limited and irregular experience.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Underground distribution installations have been made at four widely separated locations. Installations at three locations were started prior to 1941 using copper

conductor in the cable. Installation at the fourth location was started after 1950 using aluminum conductor in the cable. Those installations originally started with copper have continued to be expanded with copper and the one started with aluminum has continued to be expanded with aluminum:—principal considerations being economics in maintaining minimum stocks of wire sizes, connectors, fittings, etc., and in experience of maintenance personnel with the particular materials.

No rigid restriction or limit has been specified for use of either copper or aluminum which would be determinative for any future underground installation.

R. L. Harris
Vice President–Electric Operations
November 7, 1960

[fol. 6353] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Clay Electric Cooperative, Inc.
Keystone Heights, Florida**

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	500,000′	0	250,000′
B. Distribution lines (all wire and cable conductors used in distribution lines. up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	200,000′	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	7,000,000′	6,000,000′	5,000,000′
3. Copper wire and cable covered and insulated[3]	200,000′	100,000′	0
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	250,000′	460,000′

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. H. G. Handorfer
Manager
December 12, 1960

[fol. 6354] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Clay Electric Cooperative, Inc.
Keystone Heights, Florida

Type of Underground Cable	Answer in Thousands of Feet[2]		
	1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

C. H. G. Handorfer
Manager
December 12, 1960

[fol. 6355] United States Department of Justice

Schedule III

Clay Electric Cooperative, Inc.
Keystone Heights, Florida

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

Will continue to use only aluminum.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

Not in salt area.

C. H. G. Handorfer
Manager
December 12, 1960

[fol. 6356] United States Department of Justice

Schedule IV

Clay Electric Cooperative, Inc.
Keystone Heights, Florida

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

None.

C. H. G. Handorfer
Manager
December 12, 1960

[fol. 6357] United States Department of Justice

Schedule I

Gross Additions [1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

**Florida Power & Light Company
Miami, Florida**

Type of Overhead Line	Answer in Thousands of Feet [2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	560	208	82
2. Aluminum and aluminum alloy wire and cable-bare & ACSR.	—	442	720
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	19,180	5,940	7,183
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	—	18,250	22,091
3. Copper wire and cable covered and insulated [3]	18,580	798	847
4. Aluminum and aluminum alloy wire and cable covered and insulated [3]	—	16,880	17,943

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. L. Poor
Assistant Purchasing Agent
October 24, 1960

[fol. 6358] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Florida Power & Light Company
Miami, Florida

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	39
2. Aluminum & Aluminum Alloy	—	—	—
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	150	37	233
2. Aluminum & Aluminum Alloy	—	—	—

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. L. Poor
Assistant Purchasing Agent
October 24, 1960

[fol. 6359] United States Department of Justice

Schedule III

Florida Power & Light Company
Miami, Florida

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Expect proportion of aluminum to copper to remain approximately the same since usage of one versus the other is determined by geographic boundries, with rate of growth about the same in both areas. This is based upon the present price comparison.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Use of aluminum conductor for overhead lines is limited to areas where severe corrosion due to salt spray is not anticipated. In general this prohibits the use of aluminum within two miles of the ocean or gulf.

R. L. Poor
Assistant Purchasing Agent
October 24, 1960

[fol. 6360] United States Department of Justice

Schedule IV

Florida Power & Light Company
Miami, Florida

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

Aluminum underground cables not used, except a small amount installed by private developer and later acquired by Florida Power & Light Company.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Do not install aluminum underground cables because of anticipated corrosion problems due to salt water and soil conditions.

R. L. Poor
Assistant Purchasing Agent
October 24, 1960

[fol. 6361] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Georgia Power Company
Atlanta, Georgia

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	637	269	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5,359	3,998	798
B. Distribution lines (all wire and cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
conductors used in distribution lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
up to and including service drops	xxxxxxxx	xxxxxxxx	xxxxxxxx
but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	9,455	6,603	2,894
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5,771	5,898	11,802
3. Copper wire and cable covered and insulated[3]	19,245	13,766	4,706
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	3,654	9,301

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. E. L. O'Hirley
Asst. to V. Pres. & Gen. Mgr.
October 28, 1960

[fol. 6362] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Georgia Power Company
Atlanta, Georgia

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	38.8	38.2
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	214.3	123.3	111.7
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. E. L. O'Hirley
Asst. to V. Pres. & Gen. Mgr.
October 28, 1960

[fol. 6363] United States Department of Justice

Schedule III

Georgia Power Company
Atlanta, Georgia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

It is anticipated that the use of bare and covered copper conductor will continue to decrease in 1960. It is estimated that 15% less copper conductor will be used in 1960 than was used in 1959 and that the use of bare and covered ACSR conductor will increase by approximately this amount.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

ACSR is used in all areas except those along the seacoast. We do not use ACSR in these areas due to corrosion by salt water.

R. E. L. O'Hirley
Asst. to V. Pres. & Gen. Mgr.
October 28, 1960

[fol. 6364] United States Department of Justice

Schedule IV

Georgia Power Company
Atlanta, Georgia

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No change expected.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

The size of the existing ducts (4" inside diameter) and size of existing cable manholes make it desirable to install copper conductors to provide the maximum current carrying capacity for the installed cable. Due to existing structures of other utilities in the street it is impractical and in some cases impossible to construct larger cable manholes in existing duct lines or in newly constructed duct lines.

R. E. L. O'Hirley
Asst. to V. Pres. & Gen. Mgr.
October 28, 1960

[fol. 6365] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Mississippi Power & Light Company
P. O. Box 1640
Jackson, Mississippi

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,907	1,402	1,062
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	4,303	1,328	869
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	5,387	5,595	2,871
3. Copper wire and cable covered and insulated[3]	3,215	812	123
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	1	3,433	4,409

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Alex Rogers
Vice-President
October 27, 1960

[fol. 6366] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Mississippi Power & Light Company
P. O. Box 1640
Jackson, Mississippi

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	51	13	10
2. Aluminum & Aluminum Alloy	None	None	3

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

Alex Rogers
Vice-President
October 27, 1960

[fol. 6367] United States Department of Justice

Schedule III

Mississippi Power & Light Company
P. O. Box 1640, Jackson, Mississippi

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

It is expected that the proportion of aluminum to copper will continue to increase on a gradual basis.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

Alex Rogers
Vice-President
October 27, 1960

[fol. 6368] United States Department of Justice

Schedule IV

Mississippi Power & Light Company
P. O. Box 1640, Jackson, Mississippi

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

The proportion of aluminum to copper is expected to increase in subsequent years due to the use of underground conductor in residential areas.

The change will be on a gradual basis.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

Alex Rogers
Vice-President
October 27, 1960

[fol. 6369] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern Pine Electric Power Association
Taylorsville, Mississippi

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	None	None	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	None	None
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	75,985	43,457	80,760
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2,352,548	1,166,745	1,812,425
3. Copper wire and cable covered and insulated[3]	520,641	545,364	9,810
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	136,308	582,814

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. H. McFarland
Chief Engineer
November 30, 1960

[fol. 6370] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Southern Pine Electric Power Association
Taylorsville, Mississippi

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. H. McFarland
Chief Engineer
November 30, 1960

[fol. 6371] United States Department of Justice

Schedule III

Southern Pine Electric Power Association
Taylorsville, Mississippi

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

The proportion of aluminum to copper used is expected to remain constant in 1960 and subsequent years.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restriction of the use of aluminum because of corrosion by salt water or chemicals. The only restrictions are custom and personal preference.

O. H. McFarland
Chief Engineer
November 30, 1960

[fol. 6372] United States Department of Justice

Schedule IV.

Southern Pine Electric Power Association
Taylorsville, Mississippi

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of alumimum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No Change.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No restrictions.

O. H. McFarland
Chief Engineer
November 30, 1960

[fol. 6373] Carolina Power & Light Company
Raleigh, North Carolina

December 20, 1960.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Your File: AB:CLW, 60-0-37-256

Dear Mr. Bicks:

We are not in a position to furnish to you the information as requested in your letter of October 11, 1960, addressed to our President, Mr. L. V. Sutton. We are enclosing information as to "conductor Purchased for the Years 1950, 1955, and 1959".

Our situation was discussed over the telephone with Mr. Samuel Karp and Mr. Fosdick in the Justice Department.

Very truly yours, W. H. Weatherspoon, Vice President and General Counsel.

WHW:c
Enc.

[fol. 6374] United States Department of Justice

Schedule I

Conductor Purchased for Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Carolina Power & Light Company
Raleigh, North Carolina

Type of Overhead Line	Answer in Thousands of Feet[1] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	3.2	0	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	1,136.8	756.2	2,330.5
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	10,360.0	338.8	524.0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	2,727.6	11,651.2	7,788.5
3. Copper wire and cable covered and insulated[2]	9,290.2	499.1	362.8
4. Aluminum and aluminum alloy wire and cable covered and insulated[2]	0	7,850.3	4,971.6

[1] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[2] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. R. Doar
Chief Engineer of Lines
December 20, 1960

[fol. 6375] United States Department of Justice

Schedule II

Cable Purchased for Gross Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Carolina Power & Light Company
Raleigh, North Carolina

Type of Underground Cable	Answer in Thousands of Feet[1] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	1.2	0.9	0
2. Aluminum & Aluminum Alloy	0	0	0

[1] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. R. Doar
Chief Engineer of Lines
December 20, 1960

[fol. 6376] United States Department of Justice

Schedule III

Carolina Power & Light Company
Raleigh, North Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No change expected.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes. ACSR & aluminum usage restricted in areas of salty atmosphere or chemical contamination due to their corrosive effects.

W. R. Doar
Chief Engineer of Lines
December 20, 1960

[fol. 6377] United States Department of Justice

Schedule IV

Carolina Power & Light Company
Raleigh, North Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of alumimum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Do not use aluminum for any underground work at present.

W. R. Doar
Chief Engineer of Lines
December 20, 1960

[fol. 6378] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955, and 1959

**Duke Power Company
Charlotte, North Carolina**

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	186	15	158
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	997	2,826	2,684
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	2,900	847	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	22,107	26,935	26,179
3. Copper wire and cable covered and insulated[3]	26,465	8,829	1,785
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	8,295	11,033

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. F. Miller
Executive Vice President
October 26, 1960

[fol. 6379] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Duke Power Company
Charlotte, North Carolina

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	None	None	None
2. Aluminum & Aluminum Alloy	None	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

O. F. Miller
Executive Vice President
October 26, 1960

[fol. 6380] United States Department of Justice

Schedule III

Duke Power Company
Charlotte, North Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

Not until ratio of copper price per pound to price of aluminum per pound is reduced very materially.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No, these factors are not applicable to our service area.

O. F. Miller
Executive Vice President
October 26, 1960

[fol. 6381] United States Department of Justice

Schedule IV

Duke Power Company
Charlotte, North Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

——, ——.

[fol. 6382] South Carolina Electric & Gas Company
Post Office Box 390
Columbia, South Carolina

December 7, 1960.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

In a letter dated October 11 your office requested statements of the use of copper and aluminum wire and cable for electric power line construction during several specified calendar years.

On October 20 we wrote you that the information could not be compiled in the time allowed and that any information this Company supplies will necessarily involve estimates which would render the form of certification inappropriate.

On November 17 your Mr. Karp telephoned to request that we prepare such compilations (including estimates) as could be done without undue hardship and submit them for your examination and possible use.

Accordingly, we enclose a statement showing for the years indicated the estimated feet used in the several categories.

Very truly yours, W. J. Ready.

WJR:lt
Enclosure

[fol. 6383]

Schedule I

"Estimated"

	1950	1955	1959
Overhead Lines			
A. Transmission Lines			
1. Copper Wire and Cable-Bare	145	4	1
2 Aluminum and Aluminum Alloy-Bare	499	743	132
B. Distribution System			
1. Copper Wire and Cable-Bare	4,531	3,978	2,240
2. Aluminum and Aluminum Alloy-Bare	2,517	4,129	4,453
3. Copper Wire and Cable-Covered	3,287	3,456	1,473
4. Aluminum and Aluminum Alloy-Covered	1	309	871

Schedule II

"Estimated"

	1950	1955	1959
Underground Lines			
A. Transmission Lines			
1. Copper (Submarine)		4	
B. Distribution Lines			
1. Copper	5	26	16

Note:

1. The above figures are stated in thousands of feet.
2. South Carolina Electric & Gas issues Copper and Aluminum wire in pounds, which necessitated using wire charts to convert from pounds to feet. Consequently we have estimates in the following areas.
   (a) When it was not known whether copper wire was stranded or solid in converting from lbs. to feet the multiplier for solid wire was used.
   (b) In converting aluminum conductor from lbs. to feet in many cases it was not known whether the conductor was 6 or 7 strand. The 6 strand multiplier was used.
3. In some cases it was necessary to estimate the number of feet of wire used for each leg of a cervice. Past experience indicate that 85 feet per leg should be used.

[fol. 6384] South Carolina Electric & Gas Company
Post Office Box 390
Columbia, South Carolina

October 20, 1960.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Dear Mr. Bicks:

This is in reply to your letter of October 11, addressed to Mr. S. C. McMeekin, President of this Company, requesting by October 31, 1960 statements of the thousands of feet of copper and aluminum conductor used by this Company during the years 195[illegible] 1955 and 1959. We regret to state that it will be impossible within the time indicated to compile and supply the requested information.

Furthermore, even if substantial additional time were available, it is unlikely that we could prepare the information with sufficient exactitude to permit the type of representation prescribed for the signatory due to the necessity of making estimates for sundry periods and the conversion to feet from the units appearing in the records.

Very truly yours, W. J. Ready.

WJR:lt
CC: Mr. Arthur M. Williams, Jr., Staff Counsel

[fol. 6385] South Carolina Electric & Gas Company
Post Office Box 390
Columbia, South Carolina

December 23, 1960.

Mr. Robert A. Bicks
Assistant Attorney General
Antitrust Division
United States Department of Justice
Washington, D. C.

Attention: Mr. Fosdick

Dear Sirs:

Supplementing our letter of December 7, 1960 and in response to a telephone call from your office on December 16, 1960, I enclose a sheet showing the break down of covered aluminum wire for the years 1955 and 1959 between triplex and quadruplex, and also showing the total wire feet in each case.

The attachment also provides responses to items appearing on Schedules III and IV.

Very truly yours, W. J. Ready.

WJR:lt
Enclosure

[fol. 6386]

Schedule I

	Year	Single Wire	Total Wire Feet
Service Drops			
Alum. Triplex	1955	309	927
Alum. Triplex	1959	788	2,364
Alum. Quadruplex	1959	34	136
Distribution Secondary			
Alum. Triplex	1959	49	147

Schedule III

A. Transmission lines will be constructed entirely of aluminum conductor. Distribution lines will be constructed in almost the same ratio as 1959 aluminum to copper.

B. For distribution construction we use copper in coastal areas and certain industrial areas.

Schedule IV

A. At this time we have no aluminum underground lines. We have no major underground construction program scheduled for the immediate future.

B. At this time our underground system is small and it would not be economically feasible to stock quantities of aluminum underground fittings and tools.

FCA
12-23-60

[fol. 6387] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

S. C. Public Service Authority
Moncks Corner, South Carolina

Type of Overhead Line	Answer in Thousands of Feet[2] 1950 (1)	1955 (1)	1959 (1)
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	26.072	62.076	None
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	None	117.512	27,677.878 (2)
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx	xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
1. Copper wire and cable-bare	(3)	68.3021	111.505
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	(3)	3.728	None
3. Copper wire and cable covered and insulated[3]	(3)	287.129	299.179
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	(3)	None	None

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

Note (1) Figures are for fiscal year ending June 30. This date and quantities are for additions to property ledgers during the year.
(2) This figure includes a major transmission expansion.
(3) No accurate figures available for this year as adjustment to actual physical inventory was made June 30, 1950.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. M. Jefferies
General Manager
November 18, 1960

[fol. 6388] United States Department of Justice

Schedule II (Not Applicable)

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

S. C. Public Service Authority
Moncks Corner, South Carolina

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper			
2. Aluminum & Aluminum Alloy			

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

R. M. Jefferies
General Manager
November 18, 1960

[fol. 6389] United States Department of Justice

Schedule III

S. C. Public Service Authority
Moncks Corner, South Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Copper is used in close proximity to beaches served by the Authority.

R. M. Jefferies
General Manager
November 18, 1960

[fol. 6390] United States Department of Justice

Schedule IV (Not Applicable)

S. C. Public Service Authority
Moncks Corner, South Carolina

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of alumimum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

R. M. Jefferies
General Manager
November 18, 1960

[fol. 6391] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kingsport Utilities, Inc.
422 Broad St., Kingsport, Tenn.

Type of Overhead Line	Answer in Thousands of Feet[2]		
	1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	0	11	0
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	135	76
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	84	33	2
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	340	302	189
3. Copper wire and cable covered and insulated[3]	75	45	4
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	300	405	347

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6392] United States Department of Justice

Schedule II

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Kingsport Utilities, Inc.
422 Broad St., Kingsport, Tenn.

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	0	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	2.7	0
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true. Subject to the limitations and qualifications as set forth in my letter of November 1, 1960.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6393] United States Department of Justice

Schedule III

Kingsport Utilities, Inc.
422 Broad St., Kingsport, Tenn.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

None.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Salt water not a problem for this area. ACSR used mostly because of resistance to acid corrosion.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6394] United States Department of Justice

Schedule IV

Kingsport Utilities, Inc.
422 Broad St., Kingsport, Tenn.

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

No.

B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

Yes. Its use is restricted because we are not sure of long range effect of corrosion of aluminum in contact with moisture where a limited supply of oxygen is available. We are hopeful for an answer to this problem within the next 5 years.

Douglas Tonge
Chief Statistician
November 1, 1960

[fol. 6395] United States Department of Justice

Schedule I

Gross Additions[1] of Overhead Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Memphis Light, Gas & Water Division
179 Madison Avenue
Memphis, Tennessee

Type of Overhead Line	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission Lines	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	465	1	91
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	0	0	3,965*
B. Distribution lines (all wire and cable conductors used in distribution lines up to and including service drops but excluding service entrance cable)	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper wire and cable-bare	1,664	1,191	473
2. Aluminum and aluminum alloy wire and cable-bare & ACSR	63	601	1,610
3. Copper wire and cable covered and insulated[3]	3,650	2,560	473
4. Aluminum and aluminum alloy wire and cable covered and insulated[3]	0	102	1,700

* Includes 1,330,000 Ft. of Aluminum conductors on existing lines purchased from TVA.

---

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes, in thousands of feet of single conductor.

[3] In answering for self-supporting aerial cable, service drop, and other multiple conductor cable, include total feet of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. R. Moyers, Jr.
Vice President
November 29, 1960

[fol. 6396] United States Department of Justice

Schedule II

November 22, 1960.

Gross Additions[1] of Underground Electrical Conductor to Electric Utility Plant for Each of the Years 1950, 1955 and 1959

Memphis Light, Gas & Water Division
179 Madison Avenue
Memphis, Tennessee

Type of Underground Cable	Answer in Thousands of Feet[2] 1950	1955	1959
A. Transmission cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	0	124	0
2. Aluminum & Aluminum Alloy	0	0	0
B. Distribution cable	xxxxxxxx	xxxxxxxx	xxxxxxxx
1. Copper	139	89	49
2. Aluminum & Aluminum Alloy	0	0	0

[1] Electrical conductor installed in new construction and for replacement exclusive of conductor used for maintenance.

[2] In answering for each classification give the total, for all sizes; in thousands of feet of single conductor cable. In cases of multiple conductor cable, include the total of single conductor constituting each cable.

The aforesaid information has been supplied from books and records maintained by this utility in the regular course of business and to the best of my knowledge and belief is true.

W. R. Moyers, Jr.
Vice President
November 29, 1960

[fol. 6397] United States Department of Justice

Schedule III

Memphis Light, Gas & Water Division
179 Madison Avenue
Memphis, Tennessee

A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule I (overhead lines). If so, describe the changes indicating when they will occur.

In 1960 the proportion of copper and aluminum will be the same as 1959. We expect to use aluminum on all primary lines and on some of the secondary lines. Copper is still used on secondary lines and will be for some time.

B. State whether you restrict or limit the use of aluminum conductor for overhead lines because of corrosion by salt water or chemicals, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

No limitation.

W. R. Moyers, Jr.
Vice President
November 29, 1960

[fol. 6398] United States Department of Justice

Schedule IV

Memphis Light, Gas & Water Division
179 Madison Avenue
Memphis, Tennessee

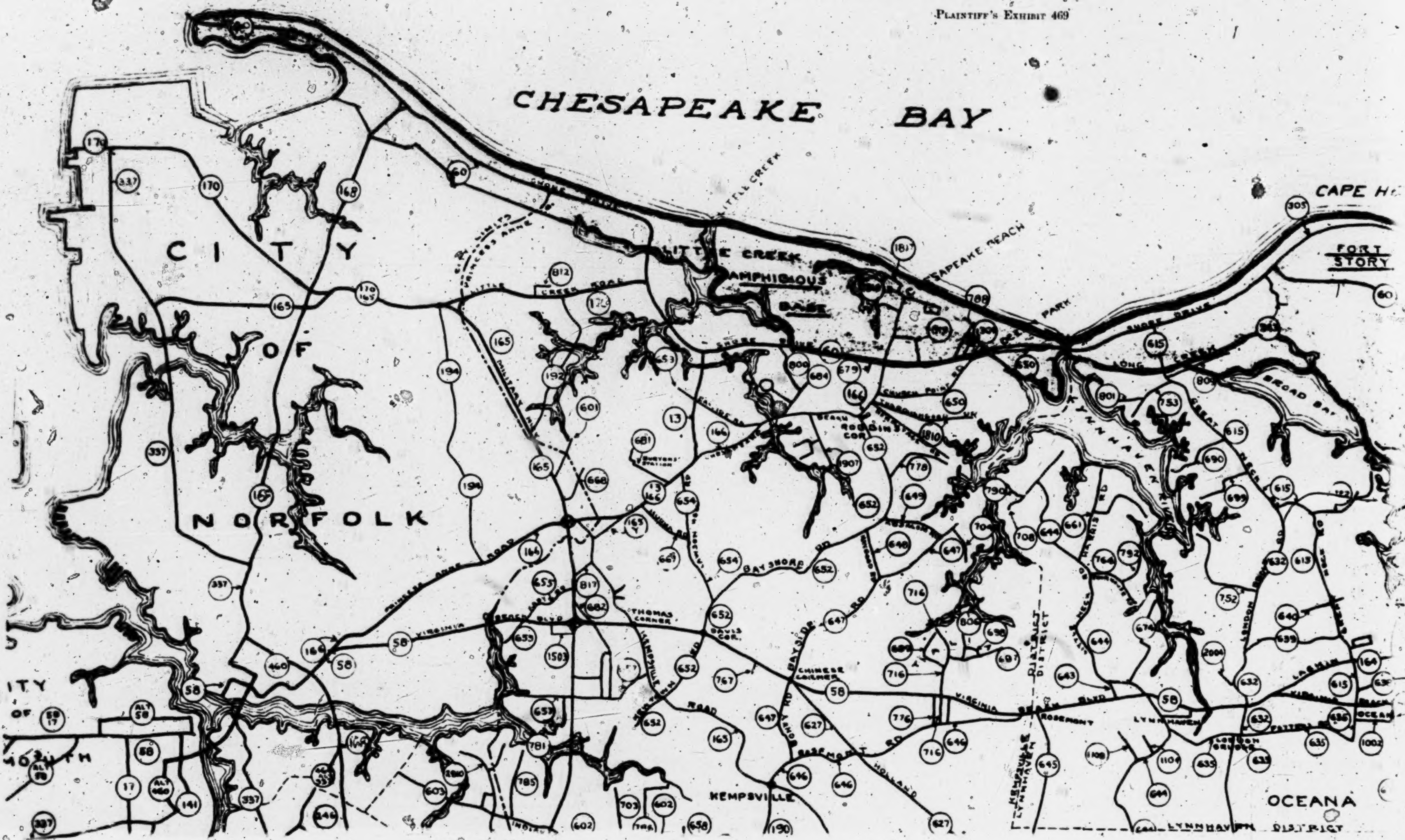
A. State whether you expect any increase or decrease in 1960 or in subsequent years in the proportion of aluminum to copper used in any classification of Schedule II (underground cables). If so, describe the changes indicating when they will occur.

We expect no change.
Aluminum will not be used in underground work.

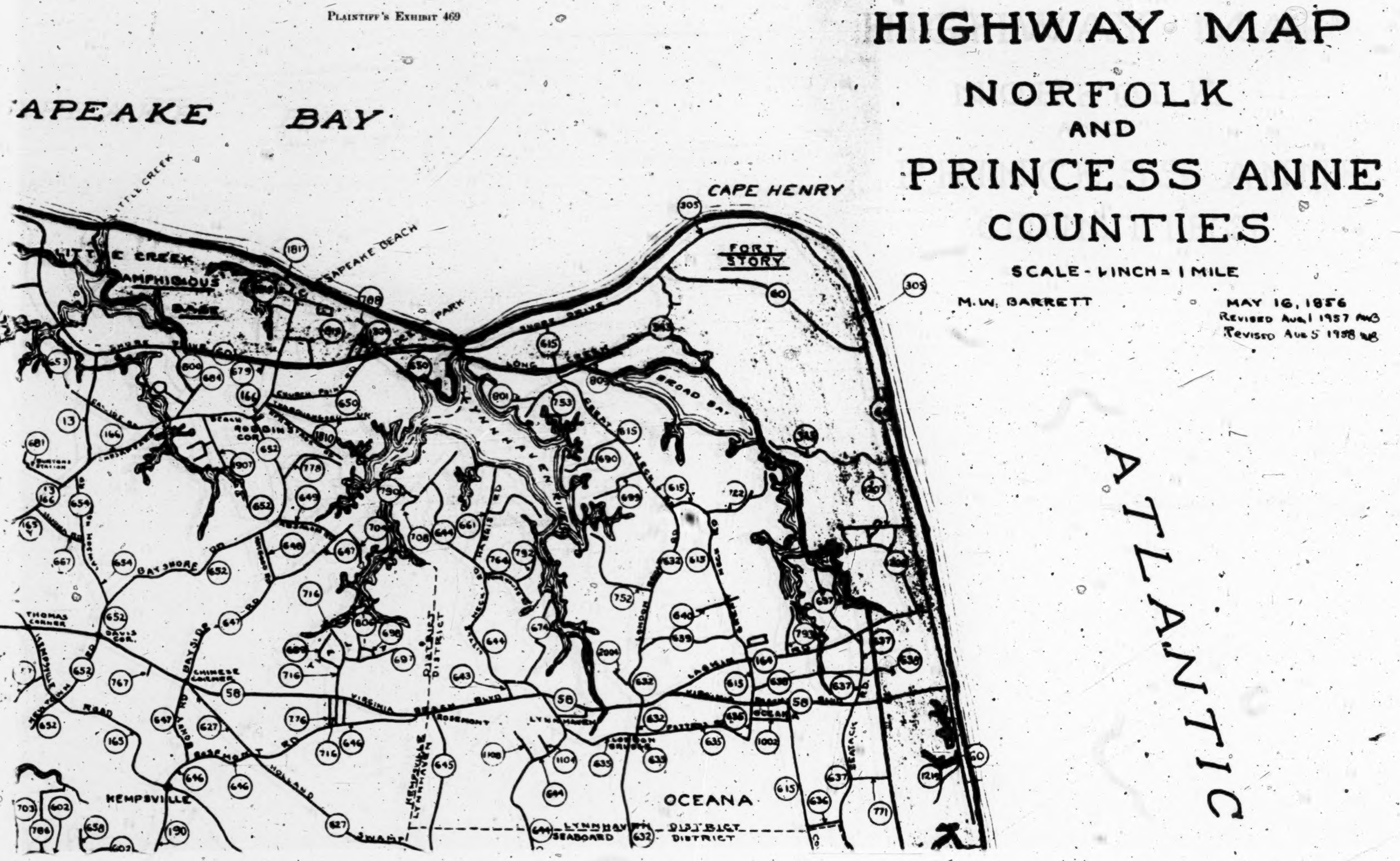
B. State whether you restrict or limit the use of aluminum conductor for underground cables because of space limitations, size of existing ducts, corrosion by salt water, soil conditions, or for other reasons. If so, describe the restrictions or limitations and give the reasons therefor.

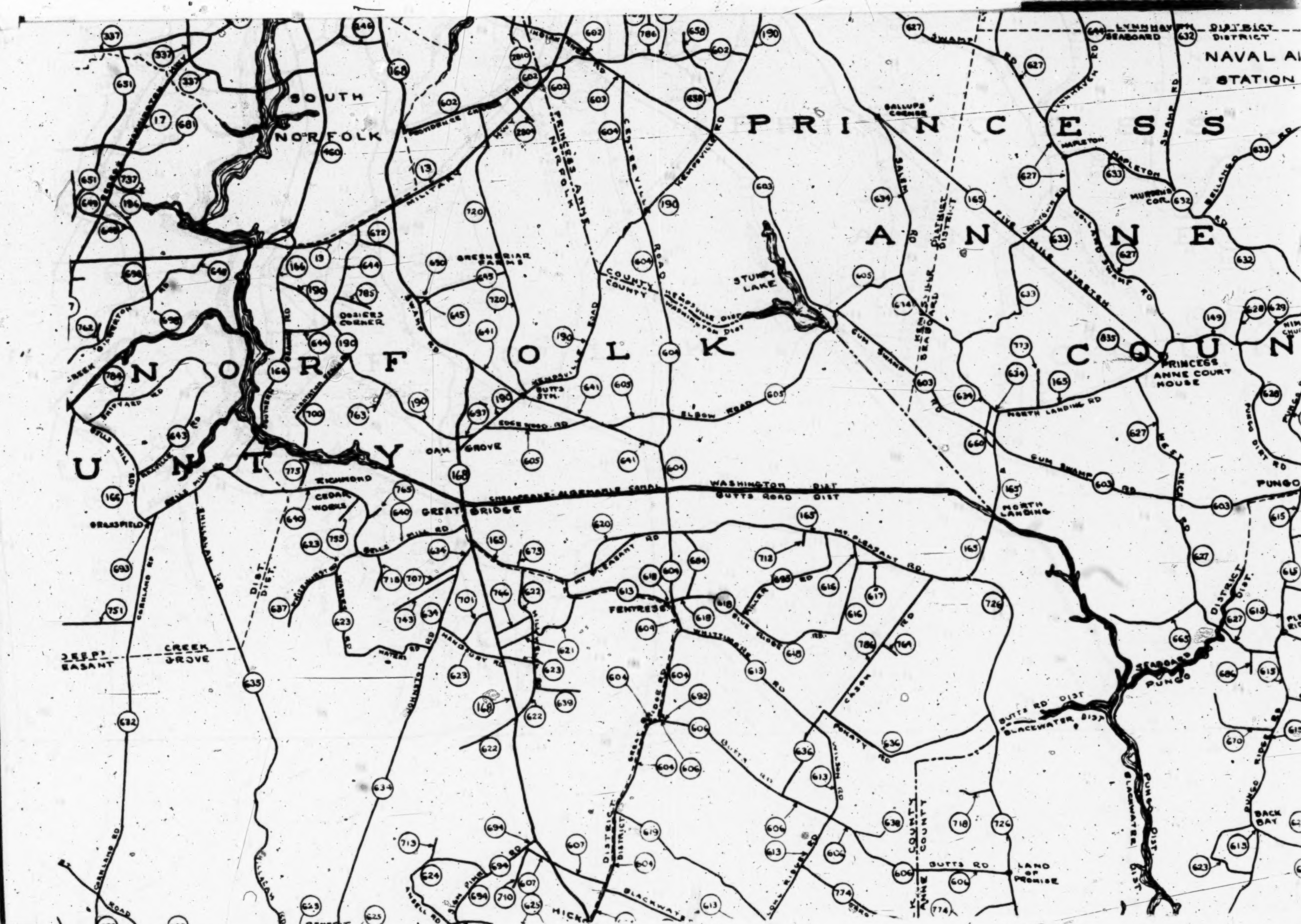
In existing underground conduits we do not use aluminum because of insufficient space for aluminum cables. In new conduit we do not use aluminum cable because of the expense of the larger conduits required by the aluminum cables.

W. R. Moyers, Jr.
Vice President
November 29, 1960

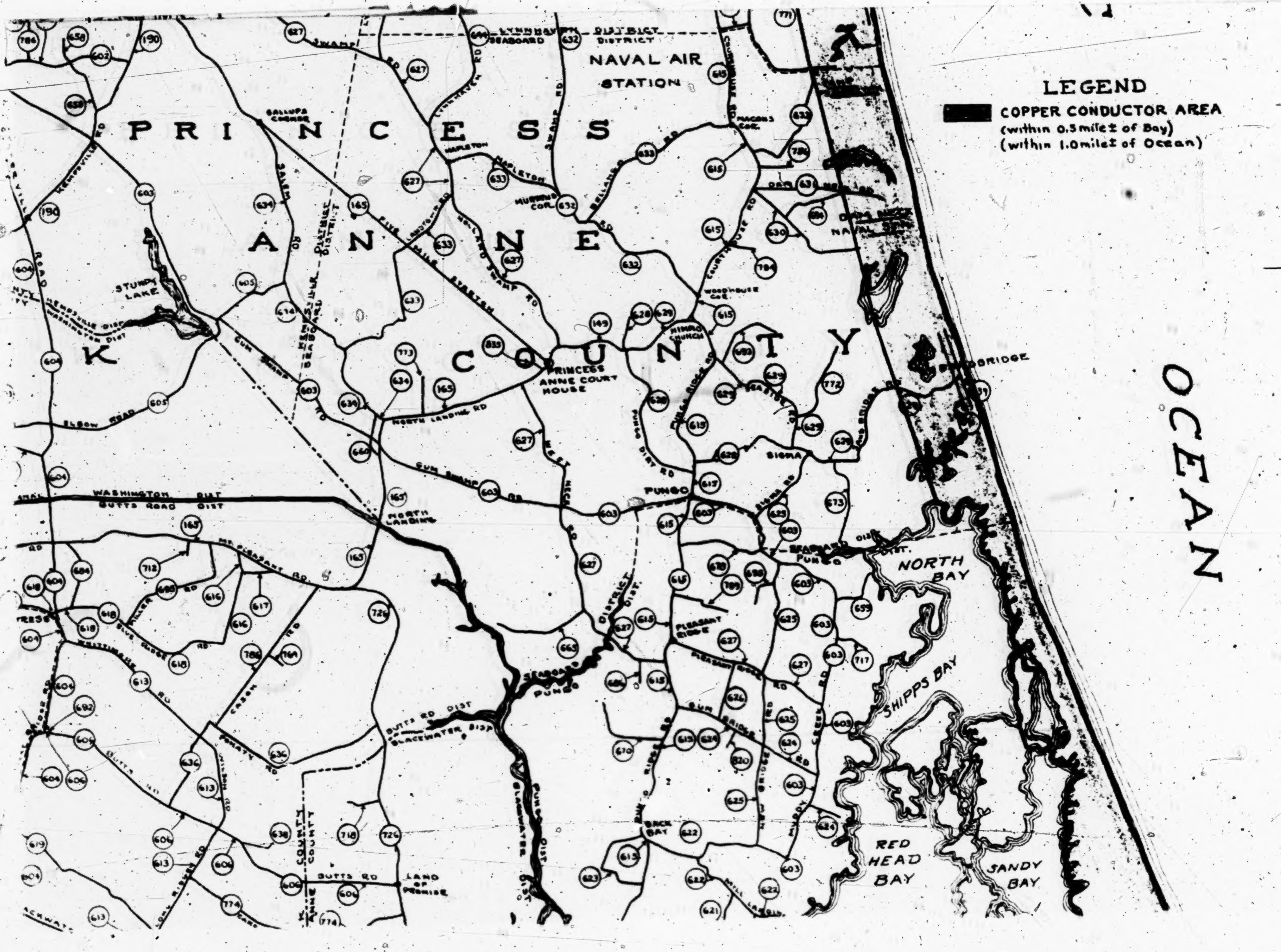


[fol. 6399] In United States District Court
Plaintiff's Exhibit 469

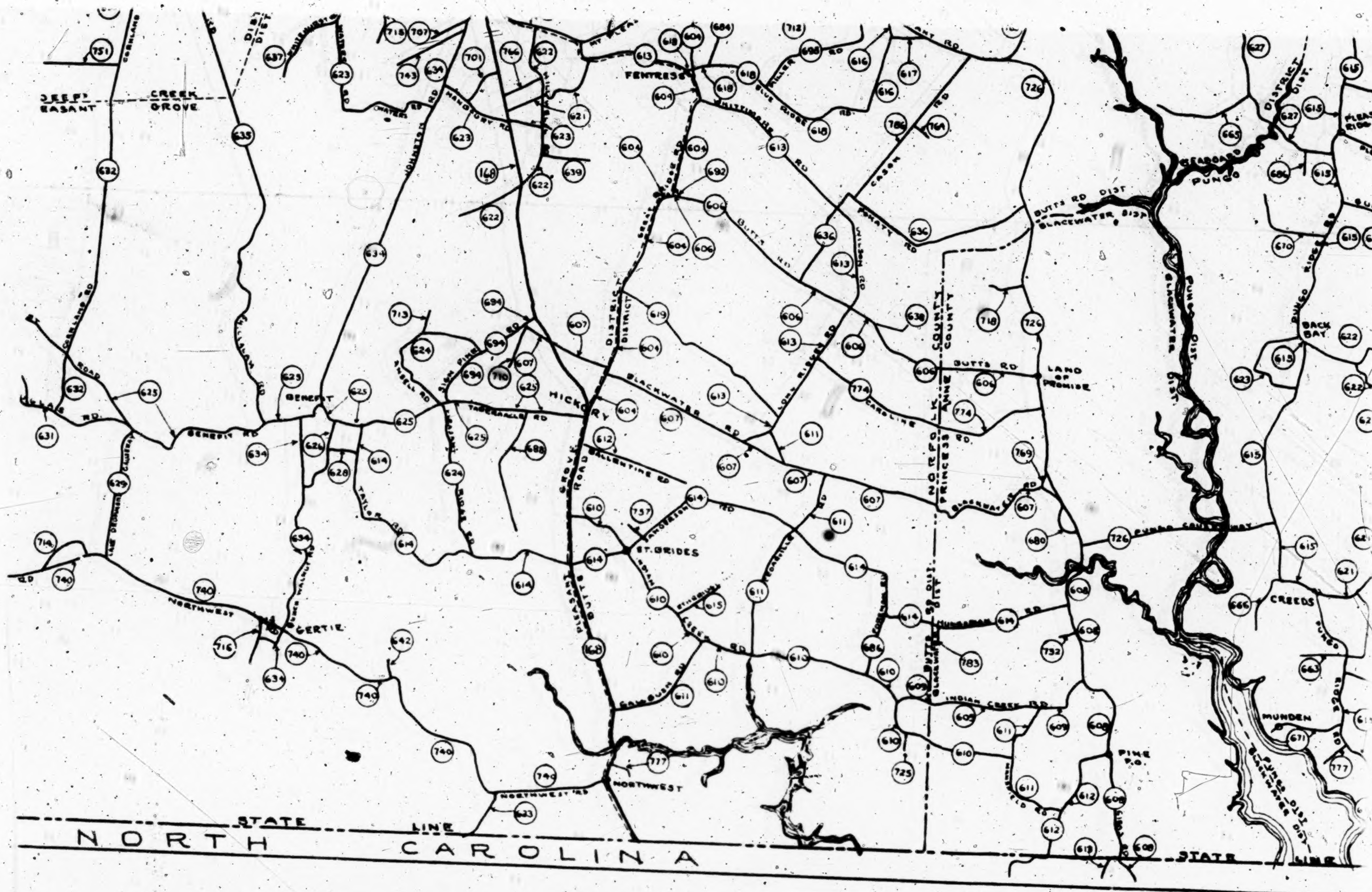




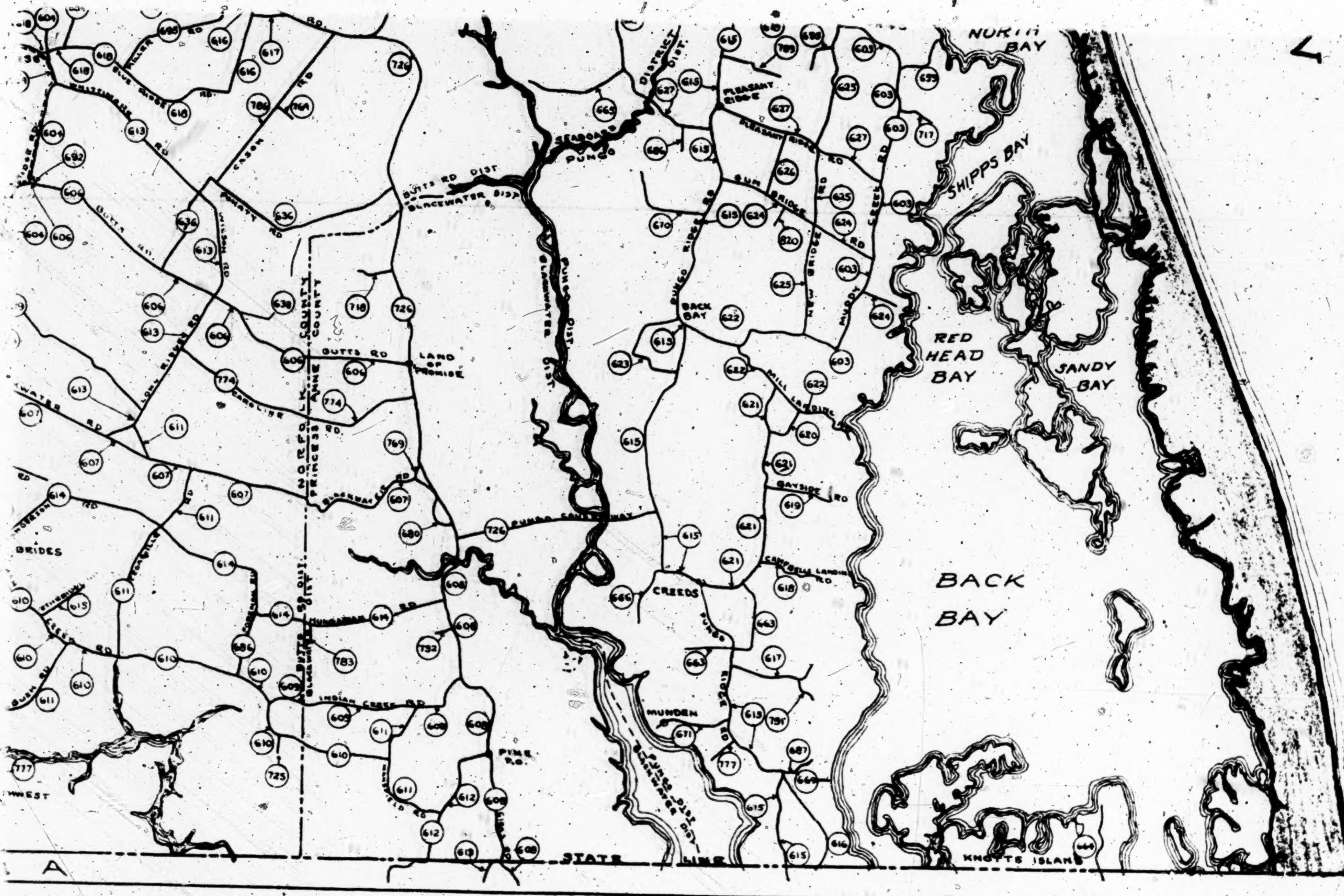
SOUTH NORFOLK
PRINCESS
ANNE
COUN
NORFOLK
COUNTY
NAVAL AI
STATION
LYNNHAVEN DIST
SEABOARD DIST
GALLUPS CORNER
STUMPY LAKE
GREENBRIAR FARMS
PROVIDENCE
MILITARY
KEMPSVILLE RD
CENTERVILLE RD
HOLLAND SWAMP RD
FIVE MILE STRETCH
PRINCESS ANNE COURT HOUSE
NORTH LANDING RD
GUM SWAMP RD
NORTH LANDING
ELBOW ROAD
EDGEWOOD RD
BUTTS STA.
OAK GROVE
GREAT BRIDGE
RICHMOND
CEDAR WORKS
GRASSFIELD
CHESAPEAKE ALBEMARLE CANAL
WASHINGTON DIST
BUTTS ROAD DIST
MT PLEASANT RD
FENTRESS
WHITTAMORE RD
BLUE RIDGE RD
FORATY RD
BUTTS RD
BUTTS RD DIST
BLACKWATER DIST
SEABOARD
PUNGO
BLACKWATER DIST
PUNGO DIST
PUNGO RIDGE RD
BACK BAY
LAND OF PROMISE
COUNTY
ANNE COUNTY
DEEP CREEK
PLEASANT GROVE
GALLBERRY RD
BLACKWATER



LEGEND
COPPER CONDUCTOR AREA
(within 0.5 mile of Bay)
(within 1.0 mile of Ocean)
PRINCESS ANNE COUNTY
OCEAN
NAVAL AIR STATION
LYNNHAVEN DISTRICT
SEABOARD DISTRICT
WASHINGTON DIST
BUTTS ROAD DIST
BLACKWATER DIST
STUMPY LAKE
PRINCESS ANNE COURT HOUSE
PUNGO
NORTH LANDING
SIGMA
PLEASANT RIDGE
BACK BAY
NORTH BAY
SHIPPS BAY
RED HEAD BAY
SANDY BAY
LAND OF PROMISE
ELBOW ROAD
GUM SWAMP RD
NORTH LANDING RD
BUTTS RD



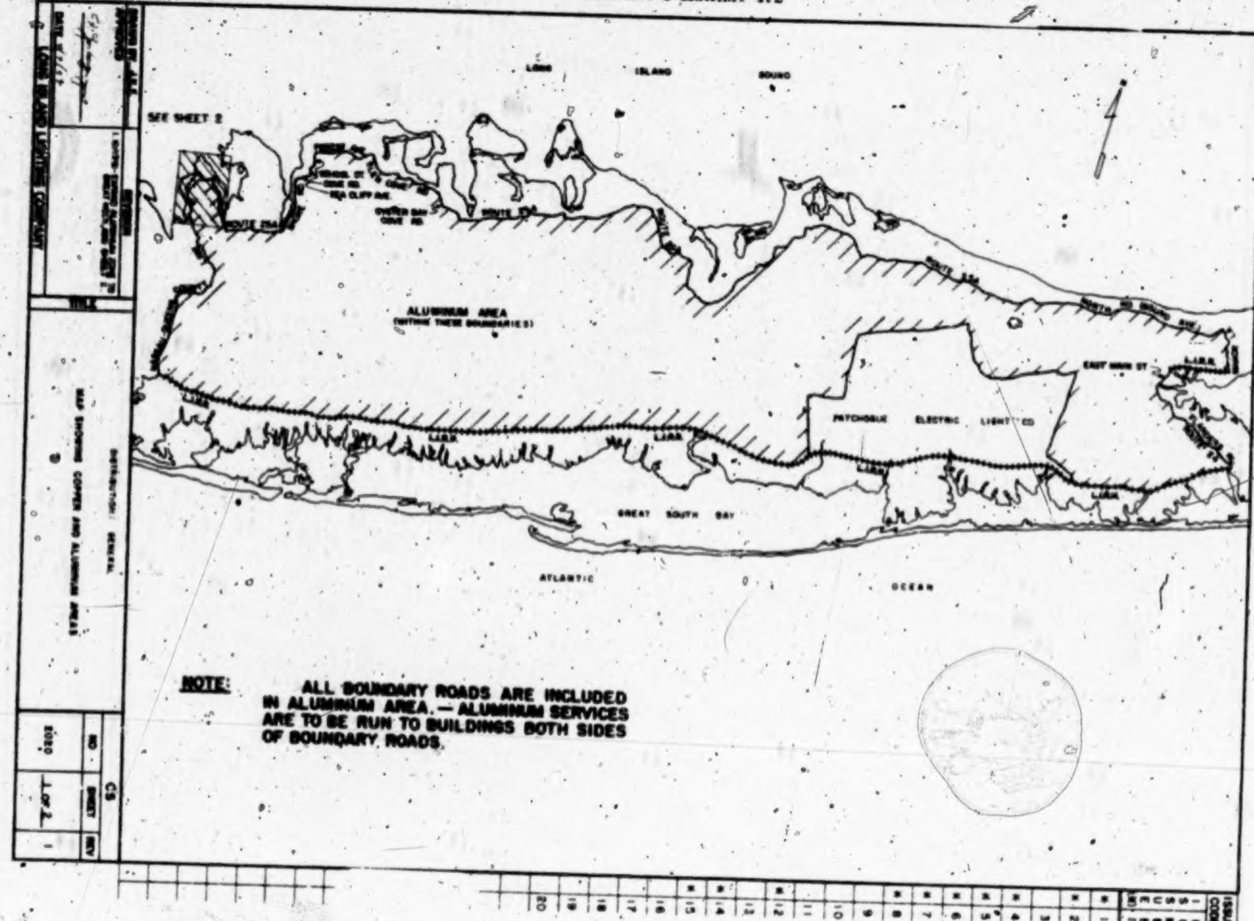
FENTRESS
HICKORY
ST. BRIDES
GERTIE
BENEFIT
NORTHWEST
CREEDS
MUNDEN
PUNGO
BACK BAY
LAND OF PROMISE
PINE P.O.
CREEK
GROVE
NORFOLK COUNTY
PRINCESS ANNE COUNTY
BUTTS RD
BLACKWATER RD
INDIAN CREEK RD
BENEFIT RD
NORTHWEST RD
CAROLINE RD
BALLENTINE RD
STATE LINE
NORTH CAROLINA



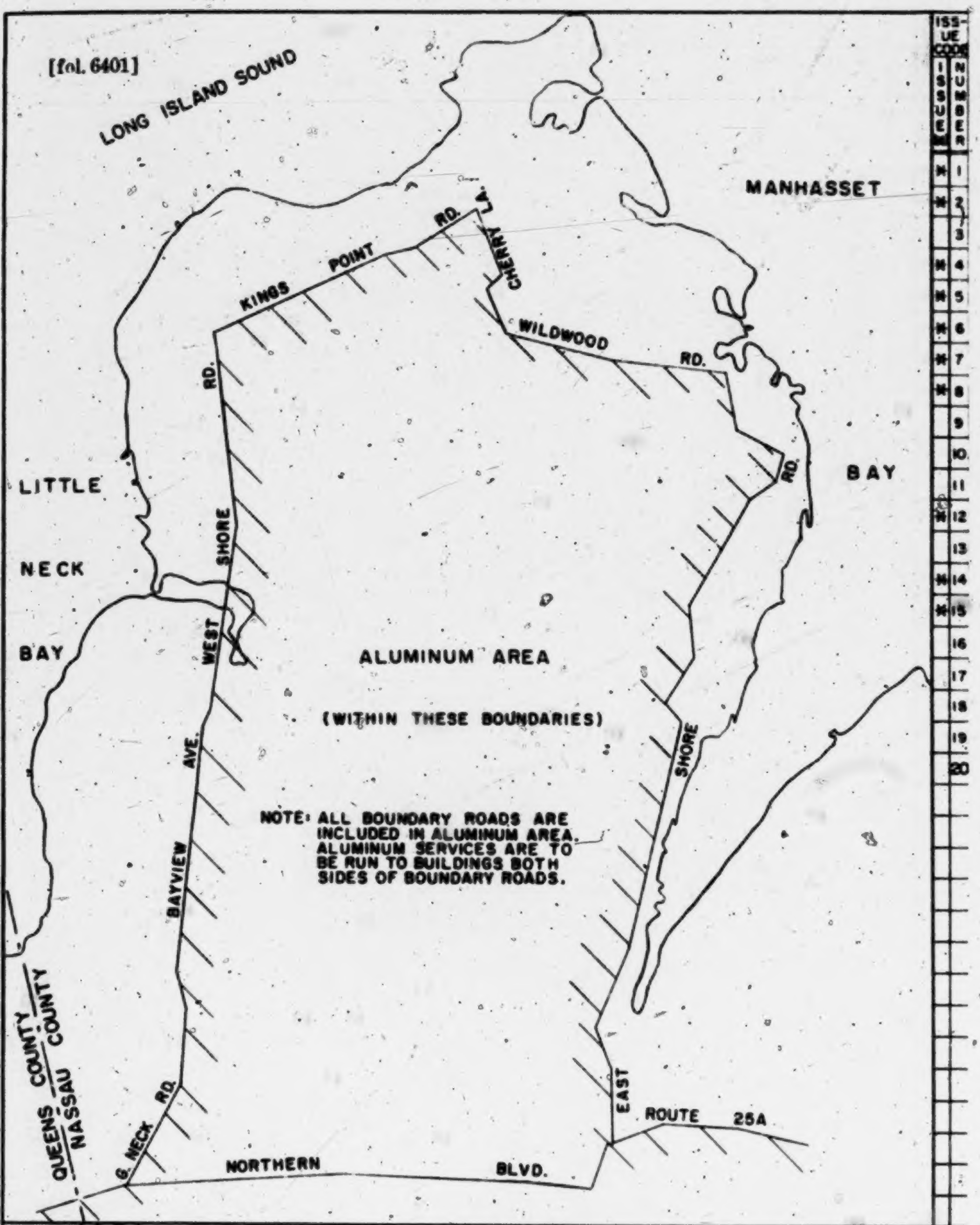
NORTH BAY
SHIPPS BAY
RED HEAD BAY
SANDY BAY
BACK BAY
PUNGO
BACK BAY
CREEDS
MUNDEN
PINE P.O.
LAND OF PROMISE
BRIDES
KNOTTS ISLAND
STATE LINE
NORFOLK COUNTY
PRINCESS ANNE COUNTY
PLEASANT RIDGE
PUNGO DIST.
BLACKWATER DIST.
BUTTS RD DIST
SEABOARD DIST.
GUM BRIDGE RD
NEW BRIDGE RD
MUDDY CREEK RD
MILL LANDING
BAYSIDE RD
CAMPBELLS LANDING RD
INDIAN CREEK RD
PUNGO FERRY
BLACKWATER RD
BUTTS RD
CAROLINE RD
A

[fol. 6400] IN UNITED STATES DISTRICT COURT

PLAINTIFF'S EXHIBIT 472



[fol. 6401]



DRAWN BY J. A. E.

REVISION

APPROVED

DATE 11-3-[illegible]

LONG ISLAND LIGHTING COMPANY

DISTRIBUTION: GENERAL

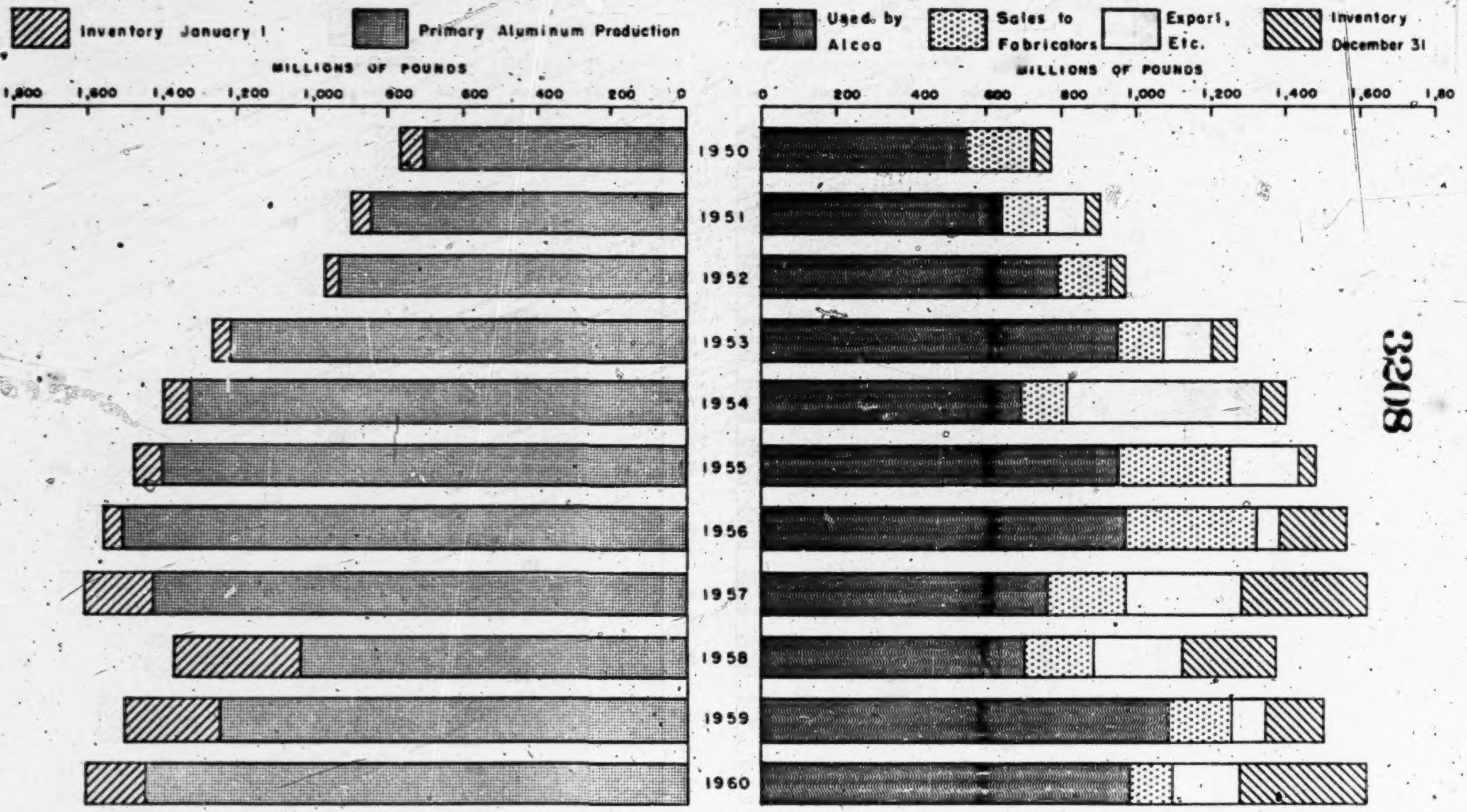
TITLE

MAP SHOWING
COPPER AND ALUMINUM AREAS
IN GREAT NECK

CS		
NO	SHEET	REV
2020	2 of 2	

PLAINTIFF'S EXHIBIT 502

ALCOA PRIMARY ALUMINUM PRODUCTION, SOLD TO CUSTOMERS, AND USED BY ALCOA



Source: Defendants' Exhibits AR44 and AR44(A).

3208

[fol. 6403]

Alcoa Primary Aluminum Production, Sold to Customers and Used By Alcoa
(000's of lbs.)

	1950	1951	1952	1953	1954	1955
Primary Aluminum Production	707,954	851,080	935,136	1,222,614	1,331,874	1,404,461
Inventory January 1	61,591	46,643	34,949	44,223	71,691	74,457
Total Available for Sales or Use	769,545	897,723	970,085	1,266,837	1,403,565	1,478,918
Sales to Fabricators	167,495	119,209	126,690	119,925	115,082	294,723
Exports, etc.[1]	562	98,996	8,631	128,448	520,450	182,174
Used by Alcoa	554,843	644,569	790,541	946,773	693,576	950,955
Inventory December 31	46,643	34,949	44,223	71,691	74,457	51,066
	769,543	897,723	970,085	1,266,837	1,403,565	1,478,918

	1956	1957	1958	1959	1960
Primary Aluminum Production	1,512,278	1,424,095	1,041,724	1,253,585	1,453,970
Inventory January 1	51,066	187,277	332,143	250,579	157,002
Total Available for Sales or Use	1,563,344	1,611,372	1,373,867	1,504,164	1,610,972
Sales to Fabricators	348,386	209,119	175,499	169,004	113,732
Exports, etc.[1]	59,912	306,910	243,043	94,209	184,150
Used by Alcoa	967,769	763,200	704,746	1,083,949	976,497
Inventory December 31	187,277	332,143	250,579	157,002	336,593
	1,563,344	1,611,372	1,373,867	1,504,164	1,610,972

[1] Exports, Stockpile, Toll Conversion, Exchange and Sales to Other Primary Producers.

Source: Defendants' Exhibits AR44 and AR44 (A).

[fol. 6404] IN UNITED STATES DISTRICT COURT

DEFENDANT'S EXHIBIT 4

U. S. Department of Commerce

Business and Defense Services Administration Aluminum and Magnesium Division

Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960 [1]
(Thousands of Pounds)

	Total	Primary producers or affiliates	Other producers
		Bare Wire	
1954	47,242	32,763	14,479
1955	63,116	44,642	18,474
1956	63,136	44,207	18,929
1957	53,585	36,235	17,350
1958	46,465	30,844	15,621
1959	66,740	45,493	21,247
1960	57,097	37,681	19,416
		Insulated or Covered Wire & Cable	
1954	25,009	17,059	7,950
1955	40,091	29,190	10,901
1956	57,588	36,024	21,564
1957	50,753	32,287	18,466
1958	51,346	36,056	15,290
1959	61,153	41,641	19,512
1960	64,215	43,197	21,018

Source: Reports on Form BDSAF-122.

[1] Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U. S. Rubber Co. "Other producers" include captive plants in all years. These figures are consequently different from figures previously released on integrated and nonintegrated shipments.

USCOMM-DC

November 8, 1961

[fol. 6405] IN UNITED STATES DISTRICT COURT

DEFENDANT'S EXHIBIT 5

Directory of Aluminum Suppliers
Revised, April 1, 1961

This Directory was Prepared for Use Only in the Aluminum and Magnesium Division and Should Not Be Construed As Being A Complete Or Official Listing.

U. S. Department of Commerce

Business and Defense Services Administration

[fol. 6406] Directory of Aluminum Suppliers

Classification	No. of Companies	Page
Primary Ingot	6	1–7
Secondary Ingot	84	8–10
Extrusion Billet	68	11–13
Sheet and Plate	34	14
Foil	16	15
Rolled Structural Shapes	2	16
Rolled Rod and Bar	9	16
Wire, bare, conductor and nonconductor	28	17
ACSR and Aluminum Cable, bare	11	18
Wire and Cable, insulated or covered	29	19
Extruded Shapes	129	20–24
Drawn Tube	17	25
Welded Tube	10	26
Powder and Paste	9	26
Forgings	41	27–28
Captive Plants (included in above products) 33 companies		29–30
Total	493*	

* Including companies listed in more than one classification.

[fol. 6407]

Aluminum Company of America

Main Office, 1501 Alcoa Building, 425 Sixth Ave., Pittsburgh 19, Pa., Ring Bldg., 1200—18th St., N. W. Washington 6, D. C.

	Plants:		
Primary Ingot	Alcoa, Tenn. Massena, N.Y. Vancouver, Wash.	Badin, N.C. Point Comfort, Tex. Wenatchee, Wash.	*Evansville, Ind. Rockdale, Tex.
Extrusion Billet	Cleveland, Ohio Lafayette, Ind. Rockdale, Tex.	Cressona, Pa. Los Angeles, Cal. Vancouver, Wash.	Detroit, Mich. New Kensington, Pa.
Sheet and Plate	Alcoa, Tenn.	Davenport, Iowa	*Edgewater, N.J.
Foil	Alcoa, Tenn.	Davenport, Iowa	Edgewater, N.J.
Rolled Structural Shapes	New Kensington, Pa. Massena, N.Y.	Vancouver, Wash.	
Rolled Rod and Bar	Massena, N.Y.	Vancouver, Wash.	
Wire, bare Conductor and nonconductor	Massena, N.Y.	Vancouver, Wash.	
ACSR and Aluminum Cable, bare	Massena, N.Y.	Vancouver, Wash.	
Wire and Cable, insulated or covered	Ft. Wayne, Ind.	Lafayette, Ind.	Massena, N.Y.
Extruded Shapes	Cressona, Pa. New Kensington, Pa.	Lafayette, Ind. Vancouver, Wash.	Los Angeles, Cal.
Drawn Tube	Lafayette, Ind.	Los Angeles, Cal.	New Kensington, Pa.
Welded Tube	Alcoa, Tenn.		
Powder and Paste	Alcoa, Tenn.	New Kensington, Pa.	
Forgings	Cleveland, Ohio	Edgewater, N.J.	Los Angeles, Cal.

* Reduction plant supplying aluminum in molten metal form.

[fol. 6408]

Subsidiaries:

	Plants:	
Cupples Products Corp. Extrusion Billets Extruded Shapes	St. Louis, Mo.	
Rea Magnet Wire Co., Inc. Wire and Cable, insulated or covered	Ft. Wayne, Ind.	Lafayette, Ind.
Rome Cable Corp. Rolled Rod and Bar Wire, bare, conductor and nonconductor ACSR and Aluminum Cable, bare Wire, and Cable, insulated or covered	Rome, N.Y.	

[fol. 6409]

Anaconda Company, The	Main Office, 25 Broadway, New York City 4, N.Y.
	1511 "K" St., N. W., Washington 5, D. C.
(Subsidiaries)	
Anaconda Aluminum Company	1430 South 13th Street, Louisville 1, Kentucky
	Plants:
Primary Ingot	Columbia Falls, Montana
Extrusion Billet	Columbia Falls, Montana
Sheet and Plate	Terre Haute, Indiana Louisville, Kentucky
Foil	Terre Haute, Indiana Louisville, Kentucky
Rolled Rod and Bar	Terre Haute, Indiana
Extruded Shapes	Terre Haute, Indiana
Drawn Tube	Terre Haute, Indiana
Anaconda Wire & Cable Co.	25 Broadway, New York 4, N.Y.
	Plants:
Wire, bare, conductor and nonconductor	Great Falls, Mont., Hastings-on-Hudson, N.Y., Orange, Calif., Sycamore, Ill., Watkinsville, Ga.
ACSR and Aluminum Cable, bare	Great Falls, Mont., Hastings-on-Hudson, N.Y., Orange, Calif., Sycamore, Ill., Watkinsville, Ga.
Wire and Cable, insulated or covered	Hastings-on-Hudson, N.Y., Marion, Ind., Orange, Calif., Sycamore, Ill., Watkinsville, Ga.

[fol. 6410]

Harvey Aluminum (Incorporated)	Main Office, 19200 South Western Ave. Torrance, Calif.
	1001 Connecticut Ave., N. W., Washington, D. C.
	Plants:
Primary Ingot	The Dalles, Ore.
Extrusion Billet	Torrance, Calif.
Rolled Rod and Bar	" "
Extruded Shapes	" "
Drawn Tube	" "
Welded Tube	" "
Forgings	" "

[fol. 6411]

Kaiser Aluminum & Chemical Corporation	Main Office, 300 Lakeside Dr., Oakland 12, California 1625 Eye St., N. W., Washington 6, D. C.	
	Plants:	
Primary Ingot	Chalmette, La. Spokane, Wash.	Ravenswood, W. Va. Takoma, Wash.
Extrusion Billet	Chalmette, La. Halethorpe, Md.	Dolton, Ill. Newark, Ohio
Sheet and Plate	Ravenswood, W. Va.	Spokane, Wash.
Foil	Ravenswood, W. Va.	Permanente, Cal.
Rolled Rod and Bar	Newark, Ohio	
Wire, bare, conductor and nonconductor	Bristol, R. I.	Newark, Ohio
ACSR and Aluminum Cable, bare	Newark, Ohio	
Wire and Cable, insulated or covered	Bristol, R. I.	Newark, Ohio
Extruded Shapes	Dolton, Ill.	Halethorpe, Md.
Drawn Tube	Dolton, Ill.	Halethorpe, Md.
Welded Tube	Spokane, Wash.	
Forgings	Erie, Pa.	

[fol. 6412]

Ormet Corporation	Hannibal (Omal) Ohio Producers for Olin Mathieson Chemical Corp., and Revere Copper and Brass Inc.
Primary Ingot	Hannibal (Omal) Ohio
Extrusion Billet	Hannibal (Omal) Ohio
Olin Mathieson Chemical Corporation	Main Office, Metals Division—8th Floor, 400 Park Ave., New York 22, N.Y. 1730 "K" Street, N.W., Washington 6, D.C.
Extrusion Billet	Gulfport, Miss.
Sheet and Plate	Hannibal (Omal) Ohio
Extruded Shapes	Gulfport, Miss., New Haven, Conn., and Almetco, Inc.-Subsidiary, Nesquehoning, Pa.
Wire, bare, conductor and nonconductor	Chattanooga, Tenn.
ACSR and Aluminum Cable, bare	Chattanooga, Tenn.
Wire and Cable, insulated or covered	Chattanooga, Tenn.
Revere Copper and Brass Incorporated	Main Office, 230 Park Avenue, New York 17, N.Y.
Extrusion Billet	Baltimore, Md.
Sheet and Plate	Baltimore, Md., Chicago, Ill., Newport, Ark.
Foil	Newport, Ark.
Extruded Shapes	Baltimore, Md.
Drawn Tube	Baltimore, Md.
Welded Tube	Baltimore, Md.
Forgings	Rome, N.Y.

[fol. 6413]

Reynolds Metals Company

Main Office, 6601 West Broad St.,
Richmond 18, Va.
918–16th St., N.W., Wash. 6, D.C.

	Plants:	
Primary Ingot	Arkadelphia, Ark. *Listerhill, Ala. *Massena, N.Y. Troutdale, Ore.	*Jones Mills, Ark. Longview, Wash. San Patricio, Tex.
Extrusion Billet	Arkadelphia, Ark. Longview, Wash. Phoenix, Ariz.	Grand Rapids, Mich. Massena, N.Y. Richmond, Va.
Sheet and Plate	Listerhill, Ala.	McCook, Ill.
Foil	Louisville, Ky.	Richmond, Va.
Rolled Structural Shapes	Listerhill, Ala.	
Rolled Rod and Bar	Listerhill, Ala.	
Wire, bare, conductor and nonconductor	Listerhill, Ala.	
ACSR and Aluminum Cable, bare	Listerhill, Ala.	
Wire and Cable, insulated or covered	Listerhill, Ala.	
Extruded Shapes	Grand Rapids, Mich. Phoenix, Ariz., Torrance, Cal.	Louisville, Ky. Richmond, Va.
Drawn Tube	Phoenix, Ariz.	Richmond, Va.
Welded Tube	Listerhill, Ala.	
Powder and Paste	Louisville, Ky.	

* Reduction plants supplying aluminum in molten metal form.

[fol. 6414] Secondary Ingot

A. M. A. Corp., P. O. Box 63, Rockville Centre, N. Y.

Abasco, Inc., P. O. Box 13367, Dallas 20, Texas

Alan-Barr Aluminum Co., Inc., 118 East Front St., Palmyra, Pa.

Allied Metal Co., 1105-15 West Liberty St., Chicago 8, Ill.

Allied Smelting Co., 1740 East 12th St., Cleveland 14, Ohio

Alloys & Chemicals Mfg. Co., Inc., 4365 Bradley Rd., S.W. Cleveland 9, Ohio

Aluminum and Magnesium, Inc., P. O. Box 720, 1 Huron St., Sandusky, Ohio and Corona, Cal.

Aluminum Billets, Inc., 3786 Oakwood Ave., Youngstown 9, Ohio

Aluminum Industries, Inc., (Triplex Corp. of America) Box 606, Pueblo, Colo.

Aluminum Smelters, Inc., P. O. Box 1517, 31-33 Vine St., New Haven 6, Conn.

Aluminum Smelters of New Jersey, Inc. (Sub. of Belmont Aluminum Extrusion Co.), Delair, N. J.

Aluminum Smelting and Refining Co., 5463 Dunham Rd., Maple Heights, Ohio

American Alloys Corp., 4446 Belleview, Kansas City 11, Mo.

American Smelting & Refining Co., Federated Metals Division, 120 Broadway, New York, N. Y.—Plants: Alton, Ill., Detroit, Mich., Los Angeles, Cal., Perth Amboy, N. J.

Apex Smelting Co., 2537 West Taylor, Chicago 12, Ill. Plants: Cleveland 5, Ohio, Long Beach, Cal.

Arkansas Alloys & Castings, Inc., 700 N. Washington Street, Magnolia, Ark.

Armet Alloys, Inc., 4338 Bradley Rd., Cleveland 9, Ohio

Associated Metals Co. of California, 2730 Peralta St., Oakland 7, Cal.

Aurora Refining Co., P. O. Box 88, Aurora, Ill.

Batchelder (Charles) Co., Inc., Botsford, Conn.

Bay Billets, Inc., 1308 Olds St., Sandusky, Ohio

Bay State Aluminum Co., Inc., P. O. Box 89, Middleboro, Mass.

Belmont Smelting & Refining Works, Inc., 330 Belmont Ave., Brooklyn 7, N. Y.

Berman Bros. Iron & Metal Co., Inc., 2501 First Ave., North Birmingham, Ala.

Briel Industries, Inc., 2232 E. Market St., New Albany, Ind. and Industrial Park, Shelbyville, Ky.

Brunswick Salvage & Foundry, Inc., Southend Shipyard, Brunswick, Ga.

Bullock (W. J.), Inc., P. O. Box 539, Fairfield, Ala.

Capital Smelting & Refining Co., P. O. 571, 7 Southwest 10th St., Oklahoma City, Okla.

Cedergren Metals Co., 1901 West Commerce St., Box 5562, Dallas 8, Texas

Certified Metals Mfg. Co., 534 West 12th St., Newport, Ky.

Chersky (Jon) & Sons, 441 Florence Ave., West Inglewood, Cal.

Cleveland Electro Metals Co., 2391 West 38th St., Cleveland 13, Ohio

Cohn (H.) & Sons, Inc., 4528 W. Division St., Chicago 51, Ill.

Colonial Metals Co., 2nd & Linden, Columbia, Pa.

Continental Copper & Steel Industries, Inc., Niagara Falls Smelting & Refining Division, 2208 Elmwood Ave., Buffalo 23, N. Y.

Delta Smelting Corp., Box 722, Macon, Georgia

[fol. 6415] Elkins (J. R.) Inc., 518 Gardner Ave., Brooklyn 22, N. Y.

Excel Smelting Corp., 1300-1310 North Seventh St., Memphis 7, Tenn.

Extrusion Ingot Co., (Sub-Precision Extrs. Inc.)—190 East Green Ave., Bensenville, Ill.

Ferer (Aaron) and Sons, Inc., 2300 East 11th St., and 3248 Long Beach Ave., Los Angeles 21, Cal.

Garfield Company, 55—1st St., Berea, Ohio

General Aluminum Smelting Co., 1506 Eastern Ave., Kansas City 26, Mo.

General Smelting Co., 2901 Westmoreland, Philadelphia 34, Pa.

Gettysburg Foundry Specialties Co., R. F. D. #2, Gettysburg, Pa.

Globe Metals Co., 1820—10th St., Oakland 20, Cal.

Goldberg Metal Refining Co., 14700 South Avalon Blvd., Gardena, Cal.

Greenfield (Samuel) Co., Inc., 31 Stone St., Buffalo 12, N. Y.

Hall Aluminum Co., P. O. Box 223, 17th & State Sts., Chicago Heights, Ill.

Hamden Smelting Co., Inc., P. O. Box 1528, Edmund St., New Haven 6, Conn.

Henning Brothers & Smith, Inc., 91-113 Scott Ave., Brooklyn 37, N. Y.

Hi-Duty Alloys Corp., 7201 East Marginal Way, Seattle 8, Wash.

Holtzman (M.) Metal Co., 5223 McKissick Ave., St. Louis 7, Mo.

Industrial Smelting Div. of Christiansen Corp., P. O. Box 205, 499 East 16th St., Chicago Heights, Ill.

Jobbins (William F.) Inc., Aurora, Ill.

Kimerling (M.) & Sons, Inc., P. O. Box 1108, 2020 Vanderbilt Rd., Birmingham 1, Ala.

Kirk (Morris P.) & Son, Inc., 2700 South Indiana St., Los Angeles 23, Cal.

Lavin (R.) & Sons, Inc., 3426 Kedzie Ave., Chicago 23, Ill.

Materials Reclamation Co., 6760 West Marginal Way, Seattle 6, Wash.

McGowan Co. Inc., 1205 South Boyle Ave., Los Angeles 23, Cal.

Milward Alloys, Inc., P.O. Box 336, North Transit & Mill Sts., Lockport, N.Y.

National Metal & Smelting Co., P.O. Box 586, 210 Northwest 4th St., Ft. Worth, Texas.

North American Smelting Co., Marine Terminal, Wilmington 99, Del.

Northwestern Metal Co., 900 "T" St., Lincoln 1, Nebr.

Paragon Smelting Corp., 36-08 Review Ave., Long Island City, New York.

Pioneer Aluminum, Inc. (Sub. of Morris P. Kirk & Sons, Inc.), P.O. Box 45367, 5251 West Imperial Highway, Los Angeles 45, Cal.

Progressive Metals Co., 16914 South Broadway, Gardena, Cal.

Renard of Connecticut, Inc., Barnum Smelting Co. Division, 1548 Barnum Ave., Bridgeport 8, Conn.

Republic Smelting & Refining Co., 19031 South Hamilton Ave., Gardena, Cal.

Rochester Smelting & Refining Co., Inc., P.O. Box 547, 26 Sherer St., Rochester 2, N. Y.

Roessing Bronze Co., Etna, 320 Barbour Street, Pittsburgh 23, Pa.

Roth Smelting Co., P.O. Box 83, Thompson Road, Syracuse 1, N. Y.

Russell (Robert) Metals, Inc., 5761 N.W. 37th Ave., Miami, Fla.

Sall (George), The, Metals Co., Inc., 2300 Butler St., Philadelphia 37, Pa.

Sonken-Galamba Corp., Riverview at Second St., Kansas City 18, Kans. Plants: Gardena, Cal., North Miami, Fla.

[fol. 6416] South Bend Smelting & Refining Co., 1610 Circle Ave., South Bend 21, Ind.

Tomke Aluminum Division, United Iron & Metals Co., Inc., 4201 East Monument St., Baltimore 5, Md.

Union Aluminum Co. Inc., Sheffield, Ala.

U. S. Aluminum Corp. of Pennsylvania, P.O. Box 8, Marietta, Pa.

U. S. Reduction Co., 4610 Melville Ave., East Chicago, Ind. Plant: Toledo, Ohio.

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

Viener (Hyman) & Son, P.O. Box 573, 5300 Hatcher St., Richmond, Va.

Wabash Smelting Inc., Wabash, Ind.

Western Metal Co., 3201 South Kedzie Ave., Chicago 23, Ill.

Youngstown Manufacturing, Inc., Metalcast Division, 70 Prospect St., Youngstown, Ohio.

[fol. 6417] Extrusion Billet

ABC, Inc. (Affil. with Fentron Industries, Inc., Seattle, Wash.) 2653 Market St., Seattle 7, Wash.

Adams Engineering Co., Inc., P. O. Box 875, Ojus, Fla. Plant: 19300 Biscayne Blvd., Miami, Fla.

Adams & Westlake Co., The, 1025 No. Michigan St., Elkhart, Ind.

Almetco, Inc.,—See Olin Mathieson Chemical Corp.

Alsco, Inc., P. O. Box 270, 225 South Forge, Akron Ohio.

Plants: 310 Allwood Rd., Clifton, N.J. and Gnadenhutten, Ohio

Aluminum Billets, Inc., 3786 Oakwood Ave., Youngstown, 9, Ohio

Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Cleveland, Ohio, Cressona, Pa., Detroit, Mich., Lafayette, Ind., Los Angeles, Cal., New Kensington, Pa., Rockdale, Tex., and Vancouver, Wash., Sub-Cupples Products Corp., St. Louis, Mo.

Aluminum Extrusion Co., 3042 Treadwell St., Los Angeles 65, Cal.

Aluminum Press Corp., 20th & Allegheny Ave., Philadelphia 32, Pa.

Aluminum Shapes, Inc., (Affil. with Belmont Aluminum Extrusions Co., Philadelphia, Pa.) 9000 River Rd., Delair, N.J.

American-International Aluminum Corp., 4851 N.W. 36th Ave., 3765 N.W. 74th St., Miami, Fla. and 495 Brokaw Rd., San Jose, Cal.

Anaconda Aluminum Co., Sub. of The Anaconda Co., 1430 South 13th St., Louisville 1, Ky. Plants: 449 North 9th St., Terre Haute, Ind., Columbia Falls, Mont.

Apex Smelting Co., 2537 West Taylor, Chicago 12, Ill.

Arkansas Alloys & Castings, Inc., Div. of Southern Extrusions, Inc., 700 N. Washington St., Magnolia, Ark.

Badger Aluminum Extrusions, 960 Georgia Ave., Brooklyn 7, N. Y.

Barberton Metal Products Co., Inc., Sub. of Weather Seal, Inc., 24 Huston St., Barberton, Ohio

Bauer Aluminum Co., P. O. Box 30218, Dallas 30, Tex. Plant: 100 W. Spring Valley Road, Richardson, Tex.

Bay Billets, Inc., 1308 Olds St., Sandusky, Ohio

Belmont Aluminum Extrusions Co.—See Aluminum Shapes, Inc.

Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26, Mich. Plant: Butler, Ind.

Bonnell (William L.) Co., Inc., The, 78 Fair St., Newman, Ga.

Briel Industries, Inc., 2232 E. Market St., New Albany, Ind., and Industrial Park, Shelbyville, Ky.

Bristol Aluminum Co., P. O. Box 11, Emilie Rd. and Green Lane, Bristol, Pa.

Capitol Door Co., Div. of Capitol Products Corp., P.O. Box 69, Mechanicsburg, Pa. Plant: Route 11, Carlisle Pyke, Mechanicsburg, Pa.

Ceco Steel Products Corp., 5601 W. 26th St., Chicago 50, Ill.

Channel Master Corp., Channel Master Road, Ellenville, N.Y.

Croft Aluminum Company, Inc., Magnolia St., McComb, Miss.

Cupples Products Corp.—See Aluminum Company of America

Detroit Gasket & Mfg. Co., Extruded Metals Division, P.O. Box 151, Belding, Mich.

Dixie Aluminum Corp., 102 North Hanks St., Rome, Ga., and Tube Div., 1200 S. Edwards St., Hattiesburg, Miss.

[fol. 6418] Extrusion Ingot Co. (Sub. of Precision Extrusions, Inc.), 190 East Green Ave., Bensenville, Ill.

Fenestra Inc., 11801 Mack Avenue, Detroit, Mich. Plant: 8501 Hegerman St., Philadelphia 36, Pa.

Flynn (Michael) Manufacturing Co., 700 East Godfrey Ave., Philadelphia 24, Pa.

Fruehauf Trailer Co., P.O. Box 202, Highway #20, Decatur, Ala.

General Motors Corp., GMC Truck & Coach Div., 660 South Blvd. East, Pontiac 11, Mich.

Harvey Aluminum (Inc.), 19200 South Western Ave., Torrance, Cal.

Hercules Aluminum Corp. (Affil. with Warrenville Window Co.), Joliet, Ill.

Himmel Brothers Co., The, 1409-15 Dixwell Ave., Hamden 14, Conn.

Hunter Engineering Co., P.O. Box 272, Riverside, Cal. Plant: 1495 Columbia Ave., Riverside, Cal.

Jarl Extrusions, Inc., Linden Ave., East Rochester, N.Y.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Dolton, Ill., Halethorpe, Md., Chalmette, La., Newark, O.

Kawneer Co., 714 North Front St., Niles, Mich. Plant: Powis Road, St. Charles, Ill.

Keller Metal Products, Inc., 4120 N.W. 26th St., Miami, Fla.

Macklanburg-Duncan Co., P.O. Box 1197, Oklahoma City, Okla. Plant: 41st and Santa Fe Sts., Oklahoma City 1, Okla.

Magnode Products, Inc., P.O. Box 292, 400 E. State St., Trenton, Ohio.

May, Inc., P.O. Box 6597, Houston 5, Texas. Plant: 5803 Alief Rd., Houston, Texas.

Midwest Aluminum Corp., 7696 W. Michigan Ave., Kalamazoo, Mich.

National Extrusion & Mfg. Co., Orchard at Elm, Bellefontaine, Ohio.

Northeast Aluminum, Inc., 65 Manchester St., Lawrence, Mass.

Olin Mathieson Chemical Corp.; Metals Div., 400 Park Ave., New York 22, N.Y. Plants: 34th St., Gulfport, Miss., (Almetco, Inc.-Sub), Nesquehoning, Pa.

Ormet Corporation, Hannibal (Omal) Ohio, (Producers for Olin Mathieson Chemical Corp. and Revere Copper and Brass Inc.)

Pfister Aluminum Corp., 54 West Allendale Ave., Allendale, N.J. Plant: 35 Vreeland St., Lodi, N.J.

Pilgrim (F. A.) Co., 4449 Lake Parke Rd., Youngstown 12, Ohio

Precision Extrusions, Inc., 720 East Green Ave., Bensenville, Ill.

Quality Aluminum Products Co., 301 Industrial Ave., Coldwater, Mich.

Revere Copper and Brass Inc., 230 Park Ave., New York 17, N.Y. Plant: Baltimore, Md.

Reynolds Metals Co., 6601 West Broad St., Richmond 18, Va. Plants: Arkadelphia, Ark., Grand Rapids, Mich., Longview, Wash., Massena, N.Y., Phoenix, Ariz., Richmond, Va.

Rogers Industries Inc., 14575 Meyers Rd., Detroit, Mich.

Russell (Robert) Metals, Inc., 5761 N. W. 37th Ave., Miami, Fla.

Saramar Aluminum Co., 4021 Mohoning Ave., Youngstown 1, Ohio

Sonken-Galamba Corp., Riverview at Second St., Kansas City 18, Kans. Plants: Gardena, Cal., and North Miami, Fla.

Southern Extrusions Inc.—See Arkansas Alloys & Castings, Inc.

Superior Industries, Inc., 3786 Oakwood Ave., Youngstown 9, Ohio and So. Amboy, N.J.

[fol. 6419] Texas Aluminum Co., Inc., P. O. Box 417, Plant Rd., Rockwall, Texas, and (West) California City, Cal.

Trim Alloys, Inc., 40 West Third St., Boston 27, Mass.

Union Aluminum Co., 111 Raleigh Ave., Sheffield, Ala.

United Wire & Supply Corp., 1497 Elmwood Ave., Providence 7, R. I. Plant: Cranston, R.I.

Valley Metal Products Co. (Sub. of Mueller Brass Co.) 800 East Bridge St., Plainwell, Mich.

Warner Mfg. Corp., 265 Watsessing Ave., Bloomfield, N.J.

Warrenville Window Co., Inc.,—See Hercules Aluminum Corp.

Wells Aluminum Corp., Box 278, 205 So. Henry St., North Liberty, Ind.

Werner (R. D.) Co., Inc., P.O. Box 580, Osgood Rd., Greenville, Pa.

Wolverine Tube, Div. of Calumet & Hecla, Inc., 17200 Southfield Rd., Allen Park, Mich. Plant: Decatur, Alabama

[fol. 6420] Sheet And Plate

Alsco Inc., 225 South Forge Street, Akron 8, Ohio.

[1] American Screen Products Co., 20 N. Wacker Dr., Chicago, Ill. Plant: Chatsworth, Ill.

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Alcoa, Tenn., Davenport, Iowa, Edgewater, N.J.

Aluminum Mills Inc., 1660 Deerfield Rd., Highland Park, Ill.

Anaconda Aluminum Co. (Sub. The Anaconda Co.), 1430 S. 13th St., Louisville, Ky. Plants: Louisville, Ky., Terre Haute, Ind.

Artcraft Venetian Blind Mfg. Co., 3958-72 Olive St., St. Louis 8, Mo.

Bridgeport Brass Company, 30 Grand Street, Bridgeport 2, Conn. Plants: Riverside, Cal., Griswald St., Warren, Ohio.

Carey-McFall Company, 2156 E. Dauphin St., Philadelphia 25, Pa.

Chase Brass & Copper Co., Inc., (Sub. of Kennecott Copper Corp.) 1914 Sidney Street, Waterbury, Conn.

Consolidated Aluminum Corp., P.O. Box 540, 1100 Richmond St., Jackson, Tenn.

Consolidated General Products Inc., P.O. Box 7425, Houston 8, Texas.

[1] Coors Company, Adolph, 600 Ninth St., Golden, Colo.

The Dow Metal Products Co. (Div. of The Dow Chemical Co.), Midland, Mich. Plants: College & Weaver Sts., Madison, Ill., 701 Liberty St., Jackson, Mich.

Eastern Products Company, 1601 Wicomico St., Baltimore, Mass.

Eastern Rolling Mills, 1122 East 180 St., New York 60, N.Y.

Fairmont Aluminum Co. (Sub. of Cerro Corp.), P.O. Box 912 Fairmont, W. Va.

General Aluminum Corp., 2221 West Jefferson St., Torrance, Cal.

[1] Hi-Ten Metal Products Corp., 21740 South Main Street, Matteson, Ill.

Hunter Engineering Co. (Mills Products Div. of), 1495 Columbia Ave., Riverside, Cal.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Ravenswood, W. Va., Spokane, Wash.

[1] Lando Products Inc., Sausalito, Cal.

Levolor Lorentzen Inc., 720 Monroe St., Hoboken, N.J.

[1] Mirro Aluminum Company, 1512 Washington St., Manitowoc, Wis.

Nichols Wire & Aluminum Co., 1725 Rockingham Road, Davenport, Iowa.

Olin Mathieson Chemical Corp., 400 Park Avenue, New York 22, N.Y. Plant: Hannibal (Omal), Ohio.

Peerless of America, 5830 N. Pulaski Rd., Chicago 30, Ill.

Quaker State Metals Co. (Div. of Howe Sound Co.), P.O. Box 1138, Manheim Pike at 230 Bypass, Lancaster, Pa.

Revere Copper and Brass Inc., 230 Park Avenue, New York 17, N.Y. Plants: Baltimore, Md., Chicago, Ill., Newport, Ark.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plants: Listerhill, Ala., McCook, Ill.

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[1] Captive Plants

[1] Rodney Metals, Inc., 1357 Rodney French Blvd., New Bedford, Mass.

Scovill Manufacturing Co., 99 Mill St., Waterbury 20, Conn. and New Milford, Conn.

United Pacific Aluminum Corp., (Div. of Cerro Corp.) 5311 Avalon Blvd., Los Angeles 11, Cal.

United Smelting & Aluminum Co., Inc., 187 Commerce St., New Haven 11, Conn.

Western Aluminum Corporation, 2421 South Yates Ave., Los Angeles 22, Cal. and 7215 South Crider St., Pico Rivera, Cal.

[fol. 6421] Foil

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Avenue, Pittsburgh 19, Pa. Plants: Alcoa, Tenn., Davenport, Iowa, Edgewater, N.J., New Kensington, Pa.

Anaconda Aluminum Co. (Sub of The Anaconda Co.), 1430 South 13th St., Louisville 1, Ky.

Consolidated Aluminum Corp., P.O. Box 540, 1100 Richmond St., Jackson, Tenn.

[1] Crown Cork & Seal Co., Inc., 9300 Ashton Rd., Philadelphia 36, Pa. Plant: Eastern Ave. & Kresson St., Baltimore, Md.

[1] Ekco-Alcoa Containers Inc., Hintz Road & Thomas St., Wheeling, Ill.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Permanente, Cal., Ravenswood, W. Va.

[1] Mirro Aluminum Co., Rolling Mill, 1512 Washington St., Manitowoc, Wis.

Premium Foil Co., Inc., 4612 Scuff Lane, Louisville, Ky.

Republic Foil Inc., 55 Triangle St., Danbury, Conn.

Revere Copper and Brass Inc., 230 Park Avenue, New York 17, N.Y. Plant: Newport, Ark.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plants: Louisville, Ky., Richmond, Va.

Reynolds (R. J.) Tobacco Co., 4th & Main Sts., Winston-Salem, N.C.

Rodney Metals, Inc., 1357 Rodney French Blvd., New Bedford, Mass.

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[1] Captive Plants

Standard Packaging Corp. (Johnston Foil Div.) 6008-6298 South Broadway, St. Louis 11, Mo.

Stranahan Foil Co., Inc., 100 Wesley St., South Hackensack, N.J.

Western Aluminum Corporation, 2421 South Yates Ave., Los Angeles 22, Cal. and 7215 South Crider St., Pico Rivera, Cal.

[fol. 6422] Rolled Structural Shapes

Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Massena, N.Y., Vancouver, Wash.

Reynolds Metals Co., 6601 West Broad St., Richmond 18, Va. Plant: Listerhill, Ala.

Rolled Rod And Bar

Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Massena, N.Y.,[3] Vancouver, Wash.—Sub. Rome Cable Corp.,[3] 421 Ridge St., Rome, N.Y.

Anaconda Aluminum Company, Sub. of The Anaconda Co., 1430 South 13th St., Louisville 1, Ky. Plant: Terre Haute, Ind.

General Cable Corp., 420 Lexington Ave., New York 17, N.Y. Plants:[3] St. Louis, Mo.,[3] Tampa, Fla.

Harvey Aluminum (Inc.) 19200 South Western Ave., Torrance, Cal.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plant: Newark, Ohio.

Nichols Wire & Aluminum Co., 1725 Rockingham Rd.,[3] Davenport, Iowa.

Proof Company, The, Sub. of Essex Wire Corp.,[3] Goshen, Ind.

Reynolds Metals Company, 6601 West Broad Street, Richmond 18, Va. Plant: Listerville, Ala.

Southwire Co., Fertilla St.,[3] Carrollton, Ga.

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[1] Captive Plants

[3] Plants producing Continuous Cast Rod and Bar

[fol. 6423] Wire, Bare, Conductor And Nonconductor

Alabama Wire Co., Inc., Sub of Columbia Metal Products, Inc., Box 648, Florence, Ala.

Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Massena, N.Y., Vancouver, Wash., Sub. Rome Cable Corp., 421 Ridge St., Rome, N.Y.

All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N.Y. and South Gate, Cal.

[1] American Steel & Wire Div., U.S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Plant: Worcester, Mass.

Anaconda Wire & Cable Co., Sub. of The Anaconda Co., 25 Broadway, New York, N.Y. Plants: Great Falls, Mont., Hastings-On-Hudson, N.Y., Orange, Cal., Sycamore, Ill., Watkinsville, Ga.

Arcola Wire Co., Beaver Rd., Branford, Conn.

Charter Wire Products, 300 Third Street, Sterling, Ill.

Durable Wire, Inc., Beaver Rd., Branford, Conn.

Essex Wire Corp., 1601 Wall St., Fort Wayne, Ind.

Florida Wire Fabrics, Hialeah, Fla.

General Cable Corp., 420 Lexington Ave., New York 17, N.Y. Plant: Perth Amboy, N.J.

General Electric Co., 1285 Boston Ave., Bridgeport 9, Conn.

General Motors Corp.—See Packard Electric Division

Kagan-Dixon Wire Corp., 400 Blair Rd., P.O. Box 346, Rahway, N.J.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Bristol, R.I., Newark, Ohio.

Kennecott Wire & Cable Co., Bourne Ave., Phillipsdale (Rumford 16), R.I.

Nesor Alloy Products Co., 282-84 Halsey St., Newark 2, N.J.

New York Wire Cloth Co., Sub. of Durall Products Co., 437 E. Market St., York, Pa.

Nichols Wire & Aluminum Co., 1725 Rockingham Rd., Davenport, Iowa.

Olin Mathieson Chemical Corp., Metals Div., 400 Park Ave., Newark 22, N.Y. Plant: Chattanooga, Tenn.

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[1] Captive Plants.

[1] Packard Electric Division of General Motors Corp., Dana Ave., Warren, Ohio.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plant: Listerhill, Ala.

Scovill Manufacturing Co., 100 Mill Street, Waterbury 20, Conn.

Seneca Wire & Manufacturing Co., Vine St., Fostoria, Ohio.

Sharon Wire Corp., Foot of Plane St., Boonton, N.J.

Southwire Co., Fertilla St., Carrollton, Ga.

United Wire & Supply Corp., 1497 Elmwood Ave., Providence, R.I. Plant: Kilvert St. & Jefferson Blvd., Hillsgrove, Warwick, R.I.

[1] Welding Alloys Mfg. Co., 744 Broad St., Newark, N.J. and 406 W. Grand St., Elizabeth, N.J.

Western Electric Co., 195 Broadway, New York 7, N.Y.

[fol. 6424] ACSR And Aluminum Cable, Bare

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Massena, N.Y., Vancouver, Wash., Sub—Rome Cable Corp., 421 Ridge St., Rome, N.Y.

Anaconda Wire & Cable Co., Sub. of The Anaconda Co., 25 Broadway, N.Y. 4, N.Y. Plants: Great Falls, Mont., Hastings-On-Hudson, N.Y., Orange, Calif., Sycamore, Ill., Watkinsville, Ga.

Central Cable Corp., 610 Washington Ave., Jersey Shore, Pa., and Freeport, Ill.

Essex Wire Corp., 1601 Wall St., Fort Wayne, Ind. Plants: Birmingham, Ala., Goshen, Ind., Marion, Ind., Tiffin, Ohio.

General Cable Corp., 420 Lexington Ave., New York 17, N.Y. Plants: Bonham, Tex., Los Angeles, Cal., Perth Amboy, N.J., Rome, N.Y., St. Louis, Mo., Tampa, Fla.

Kaiser Aluminum & Chemical Corporation, 300 Lakeside Dr., Oakland 12, Cal. Plant: Newark, Ohio.

Nehring Electrical Works, Ninth & Locust Sts., Dekalb, Ill.

Olin Mathieson Chemical Corp., Metals Div., 400 Park Ave., New York, N.Y. Plant: Chattanooga, Tenn.

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[1] Captive Plants.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plant: Listerhill, Ala.

Southwire Co., Fertilla St., Carrollton, Ga.

Texas Wire & Cable Co., Div. of Narragansett Wire Co., Plano, Tex.

[fol. 6425] Wire and Cable, Insulated or Covered

Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Sub—Rea Magnet Wire Co., Inc., 3600 E. Pontiac St., Ft. Wayne, Ind. and Concord Rd., Lafayette, Ind. Sub.—Rome Cable Corp., 421 Ridge St., Rome, N.Y.

Anaconda Wire & Cable Co., Sub., of The Anaconda Co., 25 Broadway, New York, N.Y. Plants: Hastings-on-Hudson, N.Y., Marion, Ind., Orange, Cal., Sycamore, Ill., Watkinsville, Ga.

Belden Manufacturing Co., 4647 West Van Buren St., Chicago 44, Ill. Plant: Richmond, Ind.

Central Cable Corp., 610 Washington Ave., Jersey Shore, Pa. Plant: Freeport, Ill.

Circle Wire & Cable Corp., Sub. of Cerro Corp., Circle Bldg., Maspeth, L.I., N.Y. and Hicksville, L.I., N.Y.

Collyer Insulated Wire Co., 249 Roosevelt Ave., Pawtucket, R.I.

Crescent Insulated Wire & Cable Co., 319 North Olden Ave., Trenton 5, N.J.

Electric Auto-Lite Company, Box 931, Toledo 1, Ohio. Plants: Port Huron, Mich., Hazelton, Pa.

Essex Wire Corp., 1601 Wall St., Fort Wayne, Ind. Plants: Birmingham, Ala., Goshen, Ind. and Marion, Ind.

General Cable Corp., 420 Lexington Ave., New York 17, N.Y. Plants: Emeryville, Cal., Los Angeles, Cal., Perth Amboy, N.J., Rome, N.Y., St. Louis, Mo. and Tampa, Fla.

General Electric Co., 1285 Boston Ave., Bridgeport 9, Conn., and Fort Wayne 2, Ind.

Hatfield Wire & Cable Div. of Continental Copper & Steel Industries, Inc., Hillside, N.J. and Union, N.J.

Hendrix Wire & Cable Corp., 19 Watson St., Boston 18, Mass.

Hudson Wire Co., Upper Dock, Ossining, N.Y.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr.,

Oakland 12, Cal. Plants: Bristol, R.I., Newark, Ohio.

Kerite Company, 30 Church Street, New York 7, N.Y.

Narragansett Wire Co., 541 Pawtucket Ave., Pawtucket, R.I.

National Electric Products Corp., 140 Stanwix St., Pittsburgh, Pa.

Okonite Co., Sub. of Kennecott Copper Corp., Passaic, N.J. Plants: New Brunswick, N.J., Paterson, N.J.

Olin Mathieson Chemical Corp., Metals Div., 400 Park Ave., New York 22, N.Y. Plant: Chattanooga, Tenn.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plant: Listerhill, Ala.

Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.

Southwire Co., Fertilla St., Carrollton, Ga.

Suprenant Mfg. Co., 199 Washington St., Boston 8, Mass.

Texas Wire & Cable Co., Div. of Narragansett Wire Co., Plano, Texas.

Triangle Conduit & Cable Co., Inc., Jersey & Triangle Aves., New Brunswick, N.J.

Walker Brothers, P.O. Box 33, Conshohocken, Pa.

Western Electric Co., 195 Broadway, New York 7, N.Y. Plants: Hawthorne Station, Chicago 23, Ill., Kearney, N.J., Point Breeze, Baltimore, Md.

Westinghouse Electric Corp., P.O. Box 8839, Pittsburgh 21, Pa. Plants: Buffalo, N.Y., Sharon, Pa.

[fol. 6426] Extruded Shapes

Adams Engineering Co., Inc., P.O. Box 875, Ojus, Fla. Plant: 19300 Biscayne Blvd., Miama, Fla.

[1] Adams & Westlake Co., The, 1025 No. Michigan St., Elkhart, Ind.

Aerolite Extrusion Co., The, 4605 Lake Park Rd., Youngstown 12, Ohio.

All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N.Y. Plants: 9 Naubuc Ave., Glastonbury, Conn., 4954 Firestone Blvd., Los Angeles, Cal.

Almetco, Inc.—See Olin Mathieson Chemical Corp.

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[1] Captive Plants

[4] Alsco Inc., P.O. Box 270, 225 South Forge Street, Akron, Ohio. Plants: 310 Allwood Rd., Clifton, N.J. and Gnadenhutten, Ohio.

[4] Aluminum Air Seal Mfg. Co., 4021 Mahoning Ave., Youngstown, Ohio. Plant: 3400 West Federal, Youngstown, Ohio.

[4] Aluminum Company of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh, Pa. Plants: Cressona, Pa., Lafayette, Ind., Los Angeles, Cal., New Kensington, Pa., Vancouver, Wash., Sub.—Cupples Products Corp., 2650 Hanley Rd., St. Louis, Mo.

Aluminum Extrusion Co., 3042 Treadwell St., Los Angeles 65, Cal.

Aluminum Extrusions, Inc., 815 W. Shepherd St., Charlotte, Mich. Plant: 530 West Lovett St., Charlotte, Mich.

Aluminum Industries—See Alsco.

[1] Aluminum Press Corp., 20th & Allegheny Ave., Philadelphia 32, Pa.

Aluminum Shapes, Inc., Affil. with Belmont Aluminum Extrusions Co., Philadelphia, Pa., 9000 River Rd., Delair, N.J.

Aluminwall Corp.—See Alsco, Inc.

American Art Metals Company, 433 Highland Ave., N.E., Atlanta 12, Ga. Plant: 4785 Fulton Industrial Bldg., Atlanta, Ga.

American-International Aluminum Corp., 4851 N.W. 36th Ave., 3765 N.W. 74th St., Miami, Fla. and Brokaw Rd., San Jose, Cal.

[4] Anaconda Aluminum Company, Sub. of The Anaconda Co., 1430 South 13th St., Louisville 1, Ky. Plant: 449 North 9th St., Terre Haute, Ind.

[1] Anderson, (V.E.) Mfg. Co., Inc., P.O. Box 121, Rome, Ga. Plant: Anderson Road, Rome, Ga.

[1] Arvin Industries, Inc., 13th & Big Four, Columbus, Ind. Furniture & Household Plant: 17th & Central Sts., Columbus, Ind.

Aywon Wire and Metal Corp., 745-64th St., Brooklyn 20, N.Y.

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[1] Captive Plants.

[4] Produce alloys in 2000 and 7000 Series

B & T Metals Co., The, 425 West Town St., Columbus 16, Ohio and 2240 S. Garfield Ave., Los Angeles, Cal.

[4] Badger Aluminum Extrusions, 960 Georgia Ave., Brooklyn 7, N.Y.

[1] Balcrank, Inc., Disney St. near Marburg, Cincinnati 9, Ohio.

Barberton Metal Products Co., Inc.—Sub of Weather-Seal, Inc., 24 Houston St., Barberton, Ohio.

[4] Bauer Aluminum Company, P.O. Box 30218, Dallas 30, Texas. Plant: 100 W. Spring Valley Rd., Richardson, Texas.

[fol. 6427] Bayless Products Inc., P.O. Box 188, Damascus, Ohio.

Belmont Aluminum Extrusions Co.—See Aluminum Shapes, Inc.

[4] Benson Aluminum Co., Inc., R.R. 1, Connersville, Ind.

[4] Bohn Aluminum & Brass Corp., 1400 LaFayette Bldg., Detroit 26, Mich. Plants: E. Maumee St., Adrian, Mich., 2601 Clay Ave., Detroit, Mich., and 365-24th St., Holland, Mich.

Bonnell (William L.) Co., Inc., The, 78 Fair St., Newnan, Ga.

[4] Brazeway, Inc., 2711 East Maumee St., Adrian, Mich.

[4] Bristol Aluminum Co., P.O. Box 11, Emilie Rd. & Green Lane, Bristol, Pa.

Calex Corp., 2415 Wilson Avenue, Campbell, Ohio.

Calumet & Hecla, Inc.—See Wolverine Tube

Capitol Products Corp., P.O. Box 69, Carlisle Pike, Mechanicsburg, Pa.

Cardinal Extrusions Co. (Southern Extrusions Corp. d/b/a), 6910 Preston Hiway, Louisville 13, Ky.

[1] [4] Ceco Steel Products Corp., 5601 W. 26th St., Chicago 50, Ill.

[1] Channel Master Corp., Channel Master Road, Ellenville, N.Y.

Clark Aluminum Co., P.O. Box 43558, 13131 Almeda St., Houston, Texas.

Colotrym Co., The, 35 Hanford St., Seattle 4, Wash.

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[1] Captive Plants

[4] Productive alloys in 2000 and 7000 Series

Commonwealth Extrusion Corp., P.O. Box 914, Bayamon, Puerto Rico (Controlled by Texas Aluminum Co.)

Croft Aluminum Company, Inc., Magnolia St., McComb, Miss.

Cupples Products Corp.—See Aluminum Company of America.

Detroit Gasket & Mfg. Co., Extruded Metals Division, P.O. Box 151, Belding, Mich.

Dixie Aluminum Corp., 102 North Hanks St., Rome, Ga., and Tube Division, 1200 South Edwards St., Hattiesburg, Miss.

[4] Dow Metal Products Company, The, (Div. of The Dow Chemical Company), Midland, Mich. Plant: College and Weaver Sts., Madison, Ill.

Eagle Aluminum Products Company, (Div. of The Pollock Co.), P.O. Box 32, Richboynton Road, Dover, N.J.

[4] Empire Extrusions Corp., 120 Old Broadway St., Garden City Park, L.I., N.Y.

Extruded Alloys, Inc., 800-900 X Street, Bedford, Ind.

Extruded Aluminum Company, Inc., P.O. Box 470, Industrial Road, Summerville, S.C.

Extrusions, Inc., Standiford Lane, Louisville 13, Ky.

Faulkner Associated Industries, Inc., 158 Belmont Ave., Garfield, N.J.

Feather Lite Manufacturing Co., 11710 Cloverdale Ave., Detroit 4, Mich. Plant: 828 Bay St., E. Tawas, Mich.

[fol. 6428] [1] Fenestra Inc., Hugg Rd. and E. Grand Blvd., Detroit, Mich. Plant: 8501 Hegerman St., Philadelphia 36, Pa.

[1,4] Fentron Industries, Inc., 2801 Market St., Seattle 7, Wash.

Ferguson Extrusions, Inc., 13639 Elmira Street, Detroit 27, Mich. Plant: 1320 Mt. Ellicott, Detroit 7, Mich.

Fetter Bros.—See Greater Louisville Industries, Inc.

Flynn Extrusion Corp. (Sub. of Perm-a-Trim Storm Window, Inc.), 900 South Marshall St., Marshall, Mich.

[4] Flynn (Michael) Manufacturing Co., 700 East Godfrey Ave., Philadelphia, Pa. and 18111 East Railroad St., City of Industry, Cal.

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[1] Captive Plants

[4] Produce Alloys in 2000 and 7000 Series

Fruehauf Trailer Co., P. O. Box 202, Highway #20, Decatur, Ala.

[1] Fullview Corp., 4640 Sperry, Los Angeles, Cal.

General Extrusions, Inc., 4040 Lake Park Rd., Youngstown, Ohio

General Motors Corp., GMC Truck & Coach Div., 660 South Blvd. East, Pontiac 11, Mich.

Greater Louisville Industries, Inc., P. O. Box 408, 835 Spring St., and 2nd and Ave. "D", Bldg. 243, Quartermaster Depot, Jeffersonville, Ind.

[4] Harvey Aluminum (Inc.), 19200 South Western Avenue, Torrance, Cal.

[1] Hazelwood Engineering & Equipment, Inc., 6005 Lindbergh, Hazelwood, Mo.

Hillman Manufacturing, Anglus Aluminum Div., 2020 Chico Avenue, So. Elmonte, Cal.

Himmel Brothers Co., The, 1409-15 Dixwell Ave., Hamden 14, Conn.

[1,4] Hunter Engineering Co., P. O. Box 272, Riverside, Cal. Plant: 1495 Columbia Ave., Riverside, Cal.

[1] Industrial Lamp Corporation, 14th & Blaine Streets, Elkhart, Ind.

Jarl Extrusions, Inc., Linden Ave., East Rochester, N. Y.

Jasco Aluminum Products, Div. of The Irving Air Chute Co., 31 Nassau Terminal Rd., New Hyde Park, N. Y.

Jerex Corporation, 336 Bayview Ave., Amityville, N. Y.

[4] Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Dolton, Ill., Halethorpe, Md.

Kawneer Co., 714 North Front St., Niles, Mich. Plants: Powis Rd., St. Charles, Ill., and [1] 1105 N. Frost St., Niles, Mich., and 600 Parr Blvd., Richmond, Cal.

Keystone Alloys Co., Route 982, Derry, Pennsylvania

Kinkead Industries, Inc., 5860 North Pulaski Rd., Chicago 46, Ill.

[4] Light Metals Corp., 1211 Monroe Ave., N. W., Grand Rapids 5, Mich.

Linderme Extrusions, Inc., 1365 East 219th St., Euclid 17, Ohio

Loxcreen Co., Inc., The, 4983 S. Peachtree Road, Chamblee, Georgia

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[1] Captive Plants

[4] Produce Alloys in 2000 and 7000 Series

[1] Macklanburg-Duncan Co., P. O. Box 1197, 41st and Sante Fe Sts., Oklahoma City, Okla.

Magnode Products, Inc., Extrusion Div., P. O. Box 292, 400 E. State St., Trenton, Ohio

Mainline Extrusions, Inc., 2605 South Main Street, South Bend, Ind.

Mala Extrusions, Inc., 610—37th Avenue, Rock Island, Ill.

[fol. 6429] May Inc., P. O. 6597, 5803 Alief Road, Houston, Texas

[1] Metalmasters, Inc. (Affil. with Arnold Altex Aluminum Co.), 125 Industrial Rd., Summerville, S. C.

Metal Trims, Inc., P. O. Box 632, Jackson, Miss.

Miami Extruders, Inc., 7575 Northwest 37th Ave., Miami, Fla., and 1123 E. 23rd St., Hialeah, Fla.

Miami Window Corp., Florida Extrusions Div., 1200 North Dixie Highway, Hollywood, Fla.

Mideast Aluminum Corp., U. S. Hwy. 130, Dayton, N. J. and 4 Charlton St., Princeton, N. J.

Midwest Aluminum Corp., 7696 West Michigan Ave., Kalamazoo, Mich.

Miller Industries, P. O. Box 157, Reed City, Mich.

[1] Moloney Company, The, 210 N. "A" St., Albia, Iowa

Mueller Brass Co.—See Valley Metal Products Co.

National Aluminum Co., 1133 Alum Creek Drive, Columbus 9, Ohio

[4] National Extrusion & Manufacturing Co., Orchard at Elm, Bellefontaine, Ohio

New Jersey Aluminum Extrusion Co., Inc., P. O. Box 73, North Brunswick, N. J. Plant: Jersey Ave., New Brunswick, N. J.

North American Extrusions Corp., 5569 North Riverview Dr., Kalamazoo, Mich.

Northeast Aluminum, Inc., 65 Manchester St., Lawrence, Mass.

[4] Olin Mathieson Chemical Corp., Metals Div., 400 Park Ave., N. Y. 22, N. Y. Plants: 34th Street, Gulfport, Miss. and 275 Winchester Ave., New Haven, Conn. (Almetco, Inc. —Sub.), 500 W. Catawissa St., Nesquehoning, Pa.

Pacific Extrusions, Inc., P. O. Box 1018, Judd & Beach Rd., Watsonville, Cal.

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[1] Captive Plants

[4] Produce alloys in 2000 and 7000 Series

Pax Metal Corp., 14533 Keswick St., Van Nuys, Cal.

Penn Extrusion Corp., 3837 West 20th St., Erie, Pa.

[1] [4] Pfister Aluminum Corp., 54 W. Allendale Ave., Allendale, N. J. Plant: 35 Vreeland St., Lodi, N. J.

Pilgrim (F. A.) Co., Inc., 4449 Lake Park Rd., Youngstown 12, Ohio

[4] Pittsburgh Aluminum Alloys, 2nd and Glenavy Streets, Murrysville, Pa.

Precision Extrusions, Inc., 720 East Green Ave., Bensenville, Ill.

[1] Prest-Wheel, Inc., 120 Main St., South Grafton, Mass.

Purpose Extruded Aluminum, Inc., 111 Mechanic Street, Hudson, Mich.

Quality Aluminum Products Co., 301 Industrial Ave., Coldwater, Mich.

[4] Revere Copper and Brass, Inc., 230 Park Avenue, New York 17, N. Y. Plant: 1301 Wicomico Street, Baltimore 3, Md.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plants: Grand Rapids, Mich., Louisville, Ky., Phoenix, Ariz., Richmond, Va., Torrance, Cal.

Rogers Industries, Inc., 14575 Meyers Rd., Detroit, Mich., 205 Watts Rd., Jackson, Mich., and Hutchinson, Kansas

[fol. 6430] Royal Aluminum, Inc. (Sub. of L.C.S. Corp.) P.O. Box 3023 Terminal Annex, Los Angeles 54, Cal. Plant: 3000 S. Tanager Ave., Los Angeles 22, Cal.

Royce Aluminum Corp., 704 W. Water St., Taunton, Mass.

Saramar Aluminum Co., 4021 Mahoning Ave., Youngstown 1, Ohio

[1] [4] Schumacher (F. E.) Co., Inc., 200 Mill Street, Hartville, Ohio

Scott (Alan) Aluminum Corp.—See Seasonmaster, Inc.

Seasonmaster Inc., 24 Kinkel St., Westbury, L.I., N.Y. Plant: 777 Main Street, Westbury, L.I., N.Y.

Southern Extrusions Corp.—See Cardinal Extrusions Co.

Southern Extrusions Inc., North Washington St., Magnolia, Ark.

[1] [4] Southern Metals Co., Inc. (Leased by Union Aluminum Co.), 111 Raleigh Ave., Sheffield, Ala.

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[1] Captive Plants

[4] Produce alloys in 2000 and 7000 Series

Stanley Building Specialities, Div. of The Stanley Works, 1890 N.E. 146th St., No. Miami, Fla.

[1] Stolle Corp., The, 1501 Michigan Street, Sidney Ohio

Storm Seal Industries, 22901 Aurora Rd., Bedford Hgts., Ohio

Superior Industries, Inc., 3786 Oakwood Ave., Youngstown 9, Ohio

[4] Texas Aluminum Co., Inc., P.O. Box 417, Plant Road, Rockwell Texas and Mojave, Cal.

Titus Metals Corp., P.O. Box 810, Hiway 20 West Waterloo, Iowa

[4] Trim Alloys Inc., 40 West Third St., Boston 27, Mass.

Unexcelled Chemical Corp.—See Jasco Aluminum Products

Union Aluminum Co.—See Southern Metals Co., Inc.

[1] United Wire & Supply Corp., 1497 Elmwood Ave., Providence 7, R.I. Plant: Cranston, R.I.

[4] Valley Metal Products Co. (Sub. of Mueller Brass Co.), 800 E. Bridge St., Plainwell, Mich.

[1] Ware Aluminum Windows, Inc., P.O. Box 35037 Riverside Sta., Miami, Fla. Plant: 3700 N.W. 25th St., Miami, Fla.

Warner Mfg. Corp., 265 Watsessing Ave., Bloomfield, N.J.

Warrenville Window Co., Inc., P.O. Box G, Mount & Manning Sts., Warrenville, Ill.

Weather-Seal, Inc.—See Barberton Metal Products Co.

Wells Aluminum Corp., Box 278, 205 S. Henry St., North Liberty, Ind.

[4] Werner (R. D.) Co., Inc., P.O. Box 580, Osgood Rd., Greenville, Pa.

White Metal Rolling & Stamping Corp., 80 Moultrie St., Brooklyn 22, N.Y.

Wolverine Tube, Div. of Calumet & Hecla, Inc., 17200 South Field Rd., Allen Park, Mich. Plant: Decatur, Ala.

Youngstown Manufacturing, Inc., 70 S. Prospect St., Youngstown 6, Ohio Plant: Kenmore Ave., Louisburg, N.C.

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[1] Captive Plants

[4] Produce alloys in 2000 and 7000 Series

[fol. 6431] Drawn Tube

Adams Engineering Co., Inc., P.O. Box 936, Little River Branch, Miami 38, Fla.

[4] Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Avenue, Pittsburgh 19, Pa. Plants: Lafayette, Ind., Los Angeles, Cal., New Kensington, Pa.

Anaconda Aluminum Co. (Sub. of The Anaconda Co.), 1430 South 13th St., Louisville 1, Ky. Plant: Terre Haute, Ind.

[1] Arvin Industries, Inc. (Furniture & Houseware Plant), Central Avenue, Columbus, Ind.

Calumet & Hecla Inc.—See Wolverine Tube Division

Channel Master Corp., Channel Master Road, Ellenville, N.Y.

Dixie Aluminum Corp., Tube Div., 1200 S. Edwards St., Hattiesburg, Miss.

[4] Harvey Aluminum (Inc.), 19200 South Western Ave., Torrance, Cal.

[4] Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plants: Dolton, Ill., Halethorpe, Md.

Linderme Tube Co., 1500 E. 219 St., Cleveland 17, Ohio

Penn Brass & Copper Co., 20th & Powell Ave., Erie, Pa.

Pfister Aluminum Corp., 475 Franklin Turnpike, Allendale, N.J.

Precision Tube Co., Inc., Church Rd. & Wissahickon Ave., North Wales, Pa.

[4] Revere Copper and Brass Inc., 230 Park Avenue, New York, 17, N.Y. Plant: Baltimore, Md.

[4] Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plants: Phoenix, Ariz., Richmond, Va.

Uniform Tubes, Inc., R.D. #2, Collegeville, Pa.

United Wire & Supply Corp., 1497 Elmwood Ave., Providence 7, R.I.

Wolverine Tube, Div. of Calumet & Hecla, Inc., 17200 Southfield Rd., Allen Park, Mich. and Decatur, Ala.

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[1] Captive Plants

[4] Produce alloys in 2000 and 7000 Series

[fol. 6432] Welded Tube

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Avenue, Pittsburgh 19, Pa. Plant: Alcoa, Tenn.

Aluminum Supply Co., Tube Division, 800 N. Fancher Way, Spokane, Wash. and Grand Island, Nebr.

Channel Master Corp., Channel Master Road, Ellenville, Ohio

General Tube Co., Div. of General Aluminum Corp., 2221 Jefferson St., Torrance, Cal.

Habco Manufacturing Company, P. O. Box 464, Columbus, Nebr.

Harvey Aluminum (Inc.), 19200 South Western Ave., Torrance, Cal.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plant: Spokane, Wash.

Revere Copper and Brass Inc., 230 Park Avenue, New York 17, N. Y. Plant: Baltimore, Md.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plant; Listerhill, Ala.

Westube Co., Inc., 351 Embarcadero, Oakland 6, Cal.

Powder and Paste.

Allied Metals Corp., P. O. Box 13, Pompton Lakes, N. J. and Wanaque, N. J.

Alloys & Chemicals Corp., 4365 Bradley Rd., S. W., Cleveland 9, Ohio

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Avenue, Pittsburgh 19, Pa. Plants: Alcoa, Tenn., New Kensington, Pa.

Magna Manufacturing Co., Inc., 4th Avenue, Haskell, N. J.

Metals Disintegrating Co., Inc., P. O. Box 290, Morris Ave., Elizabeth, N. J. Plants: Townley, Union Township, N. J., Albany, Cal.

Reade Manufacturing Co., Inc., 135 Hobokin Ave., Jersey City 2, N. J., and Lakewood, N. J.

Reynolds Metals Company, 6601 West Broad St., Richmond 18, Va. Plant: Louisville, Ky.

Silberline Manufacturing Co., Inc., 425 Fairfield Ave., Stamford, Conn.

Valley Metallurgical Process Co., Inc., 49 Main Street, Essex, Conn. Plant: Centerbrook, Conn.

[fol. 6433] Forgings

Accurate Brass Corp., The (Sub. of The Bristol Brass Corp.), 201 Pine St., Bristol, Conn.

Aluminum Co. of America, 1501 Alcoa Bldg., 425 Sixth Ave., Pittsburgh 19, Pa. Plants: Cleveland, O., Edgewater, N. J., and Los Angeles, Cal.

Auld Co., (D. L.) The, Fifth Ave. & Fifth St., Columbus 1, Ohio

Bergman Manufacturing Co., 27 Bay St., San Rafael, Cal.

Bessemer Forging Co., Route 9, Box 91 G, Hicks Field, Ft. Worth, Texas

Billings & Spencer Co., The, 1 Laurel St., Hartford 1, Conn.

Bohn Aluminum & Brass Corp., 1400 Lafayette Bldg., Detroit 26, Mich. Plants: 2619 Clay Ave., Detroit 11, Mich., 365 W. 24th St., Holland, Mich.

Brass Forgings Co., 1351 Jarvis Ave., Ferndale 20, Mich.

Brewer-Titchener Corp., The, Cortland Forging Div., 45 Cleveland Street, Cortland, N. Y.

Bridgeport Brass Co., Aluminum Division, 30 Grand St., Bridgeport 2, Conn. Plants: 3016 Kansas Ave., Riverside, Cal., and Cored Forging Div., Connecticut Ave., South Norwalk, Conn.

Bristol Brass Corp.—See Accurate Brass Corp.

Chemetron Corp.—See Tube Turns

Consolidated Industries, Inc., Mixville Rd., Cheshire, Conn.

Crow (W. "Rat") Inc., 200 Luxton St., Ft. Worth, Texas

Dirilyte Co. of America, Inc., 1142 South Main St., Kokomo, Ind.

General Metals Corp., Foundry and Forge Div., P. O. Box 2496 Terminal Annex, Los Angeles 54, Cal.—Plant: 5701 So. Boyle Ave., Los Angeles, Cal.

Harvey Aluminum (Inc.), 19200 South Western Avenue, Torrance, Cal.

Harvey Metal Corp., The,—Div. of Chicago Extruded Metals Co., 1605-1725 West 74th St., Chicago 36, Ill.

Hawley Forge & Mfg. Co., Inc., 2350 Jerrold Avenue, San Francisco 24, Cal.

Hunter Engineering Co., 1495 Columbia Ave., Riverside, Cal.

Imperial Brass Mfg. Co., The, 6300 West Howard St., Chicago 31, Ill. Plant: Niles 48, Ill.

Joost Manufacturing Co., 742 Bancroft Way, Berkeley 10, Cal.

Kaiser Aluminum & Chemical Corp., 300 Lakeside Dr., Oakland 12, Cal. Plant: 1015 East Twelfth St., Erie, Pa.

Kohler Co., Kohler, Wisconsin

Ladish Pacific Div., Landish Co., 3321 S. Slauson Ave., Los Angeles 58, Cal.

McKaig-Hatch, Inc., 125 Skillen St., Buffalo 7, N. Y.

McWilliams Forge Company, Inc., 1948 Franklin Ave., Rockaway, N. J.

Mondie Forge Co., Inc., 10300 Berea Rd., Cleveland 2, Ohio

Mueller Brass Co., 1925 Lapeer Ave., and 3609—32nd St., Port Huron, Mich.

Parker-Hannifin Appliance Corp., 17325 Euclid Ave., Cleveland 12, Ohio

Precision Forgings, Inc., 6th & St. Louis Aves., Valley Park, Mo.

Reisner Forge Co., 5241 E. Firestone Place, South Gate, Cal.

Revere Copper and Brass Inc., 230 Park Avenue, New York 17, N. Y. Plant: Rome Mfg. Co. Div., 201-203 Mill Street, Rome, N. Y.

Schick Products, Inc., P. O. 867, Belmont, Cal. Plant: 591 Quarry Road, Belmont, Cal.

[fol. 6434] Scovill Mfg. Co., 99 Mill St., Waterbury 20, Conn.

Standard Forgings Corp., 80 E. Jackson Blvd., Chicago 4, Ill. Plant: 3444 Dickey Rd., East Chicago, Ind.

Storms Drop Forging Co., 70 Storms Court, Springfield, Mass.

Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill. Plant: 2500 East Dunes Highway, Gary, Ind.

Titan Metal Manufacturing Co., Div. of Cerro Corp., Bellefonte, Pa. and Newark, Cal.

Tube Turns,—Div. of Chemetron Corp., 224 East Broadway, Louisville, Ky. Plant: 718 S. 28th St., Louisville, Ky.

Weatherhead Co., The, Special Products Div., 300 East 131st St., Cleveland 8, Ohio, and Fort Wayne Div., 128 W. Washington Blvd., Fort Wayne, Ind. Plants: Antwerp, Ohio and Cleveland, Ohio

Williams (J. H.) & Co., 400 Vulcan St., Buffalo 7, N. Y.

Wyman-Gordon Co., General Offices and Worcester Plant —105 Madison St., Worcester, Mass., Grafton Plant—North Grafton, Mass.

[fol. 6435] Captive Plants

(Captive plants are plants which produce mill products for their own use only in further fabrication and not for sale)

Adams & Westlake Co., The, 1025 No. Michigan St., Elkhart, Ind. Extruded Shapes

Aluminum Press Corp., 20th & Allegheny Ave., Philadelphia, 32 Pa. Extruded Shapes

American Screen Products Co., 20 N. Wacger Dr., Chicago, Ill. Sheet

American Steel & Wire Div., U.S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio. Plant: Worcester, Mass. Wire, bare

Anderson, (V. E.) Mfg. Co., P.O. Box 121, Rome, Ga. Plant: Anderson Road, Rome, Ga. Extruded Shapes

Arvin Industries, Inc., 13th & Big Four, Columbus, Ind. Furniture & Household Plant, 117th & Central, Columbus, Ind. Extruded Shapes

Balcrank, Inc., Disney St., near Marburg, Cincinnati 9, Ohio. Extruded Shapes

Ceco Steel Products Corp., 5601 W. 26 St., Chicago 50, Ill. Extruded Shapes

Channel Master Corp., Channel Master Road, Ellenville, N.Y. Extruded Shapes

Coors Company, Adolph, 600 Ninth St., Goldon, Colo. Sheet

Crown Cork & Seal Co., Inc., 9300 Ashton Road, Philadelphia 36, Pa. Plant: Eastern Ave. & Kresson St., Baltimore, Md. Sheet; foil

Ekco-Alcoa Containers, Inc., Hintz & Thomas St., Wheeling, Ill. Foil

Fenestra, Inc., 11801 Mack Avenue, Detroit, Mich. Plant: 8501 Hegerman St., Philadelphia 36, Pa. Extruded Shapes

Fentron Industries, Inc., 2801 Market St., Seattle 7, Wash. Extruded Shapes

Fullview Corp., 4640 Sperry, Los Angeles, 39, Cal. Extruded Shapes

Hi-Ten Metal Products Corp., 21740 South Main St., Matteson, Ill. Sheet

Hunter Engineering Co., P.O. Box 272, Riverside, Cal. Plant: 1495 Columbia Ave., Riverside Cal. Extruded Shapes

Industrial Lamp Corp., 14th & Blaine Sts., Elkhart, Ind. Extruded Shapes

Lando Products, Inc., Sausalito, Cal. Sheet

Macklanburg-Duncan Co., Box 1197, 41st & Santa Fe Sts., Oklahoma City, Okla. Extruded Shapes

Metalmasters, Inc., (Affil. with Arnold Altex Aluminum Co.), 125 Industrial Rd., Summerville, S.C. Extruded Shapes

Mirro Aluminum Co., 1512 Washington St., Manitowoc, Wis. Sheet; foil

Moloney Company, The, 210 N. "A" St., Albia, Iowa Extruded Shapes

Packard Electric Div., General Motors Corp., Dana Ave., Warren, Ohio. Wire, bare

Pfister Aluminum Corp., 54 Allendale Ave., Allendale, N.J. Plant: 35 Vreeland St., Lodi, N.J. Extruded Shapes

[fol. 6436] Prest-Wheel, Inc., 120 Main St., South Grafton, Mass. Extruded Shapes

Rodney Metals, Inc., 1357 Rodney French Blvd., New Bedford, Mass. Sheet

Schumacher (F. E.) Co., Inc., 200 Mill Street, Hartville, Ohio. Extruded Shapes

Southern Metals Co., Inc., (leased by Union Aluminum Co.) 111 Raleigh Ave., Sheffield, Ala. Extruded Shapes

Stolle Corp., The, 1501 Michigan St., Sidney, Ohio Extruded Shapes

United Wire & Supply Corp., 1497 Elmwood Ave., Providence 7, R.I. Plant: Cranston, R.I. Extruded Shapes

Ware Aluminum Windows, Inc., P. O. Box 35037, Riverside Station, Miami, Fla. Plant: 3700 N.W. 25th St., Miami, Fla. Extruded Shapes

Welding Alloys Mfg., Co., 744 Broad St., Newark, N.J. and 406 W. Grand St., Elizabeth, N.J. Wire, bare

DEFENDANTS' EXHIBIT 7

PRIMARY ALUMINUM CAPACITY, PRODUCTION AND SUPPLY

Year	Primary Aluminum Capacity				Primary Aluminum Production				United States Primary Aluminum Supply			
	Canada	United States	Alcoa	Alcoa Percent of U.S. %	Canada	United States	Alcoa	Alcoa Percent of U.S. %	U.S. Primary Production	U.S. Imports Crude Aluminum	Total	Alcoa Production As Percent of Total Supply %
1948	" "	1,298,000	650,000	50	734,158	1,246,912	652,309	52	1,246,912	166,328	1,413,240	46
1949	" "	1,454,150	588,000	40	738,932	1,206,924	582,783	48	1,206,924	154,686	1,361,610	43
1950	" "	1,710,000	739,500	43	793,764	1,437,244	707,954	49	1,437,244	353,556	1,790,800	40
1951	" "	1,691,500	742,500	44	894,190	1,673,762	851,080	51	1,673,762	244,844	1,918,606	44
1952	" "	2,283,900	968,500	42	999,516	1,874,660	935,136	50	1,874,660	256,466	2,131,126	44
1953	" "	2,621,400	1,096,000	42	1,096,890	2,504,026	1,222,614	49	2,504,026	601,856	3,105,882	39
1954	1,275,000	2,776,400	1,141,000	41	1,115,794	2,921,130	1,331,874	46	2,921,130	430,500	3,351,630	40
1955	1,300,000	3,218,400	1,413,000	44	1,225,086	3,131,442	1,404,461	45	3,131,442	355,305	3,486,747	40
1956	1,524,000	3,551,000	1,585,000	45	1,240,642	3,357,908	1,512,278	45	3,357,908	432,803	3,790,711	40
1957	1,639,400	3,683,500	1,585,000	43	1,113,430	3,295,418	1,424,095	43	3,295,418	444,316	3,739,734	38
1958	1,642,000	4,388,500	1,596,500	36	1,268,204	3,131,114	1,041,724	33	3,131,114	510,645	3,641,759	29
1959	1,732,000	4,805,500	1,596,500	33	1,187,260	3,906,350	1,253,585	32	3,906,350	479,141	4,385,491	29
1960	1,756,000	4,937,500	1,706,500	35	1,522,714	4,028,994	1,453,970	36	4,028,994	309,413	4,338,407	34

Quantities as thousands of pounds.

Source of Data

Canadian Primary Aluminum Capacity
American Metal Market "Metal Statistics" Handbook
Year 1954 - Edition of 1955 page 633
Year 1955 - Edition of 1956 page 608
Year 1956 - Edition of 1957 page 617
Year 1957 - Edition of 1958 page 614
Year 1958 - Edition of 1959 page 595
Year 1959 - Edition of 1960 page 600
Year 1960 - Edition of 1961 page 596

United States Primary Aluminum Capacity
U.S. Bureau of Mines Minerals Yearbook, or "Aluminum" Preprints

Year 1948 - Edition of 1948 Preprint, text page 3
Year 1949 - Edition of 1951 Yearbook, table 3, page 133
Year 1950 - Edition of 1951 Yearbook, table 3, page 133
Year 1955 - Edition of 1955 Preprint, text page 1
Year 1956 - Edition of 1956 Preprint, table 3, page 4
Year 1957 - Edition of 1957 Preprint, table 2, page 4
Year 1958 - Edition of 1958 Preprint, table 3, page 4
Year 1959 - Edition of 1959 Preprint, table 4, page 3

U.S. Bureau of Mines, Mineral Industry Surveys, Mineral Market Report
Year 1960 - Survey No. 3258, "Aluminum in 1960", table 4, page 4

American Bureau of Metal Statistics Yearbook
Year 1951 - page 96
Year 1952 - page 96
Year 1953 - page 97
Year 1954 - page 98

Source of Data (Continued)

Canadian Primary Aluminum Production
American Bureau of Metal Statistics Yearbook

Year 1948 - Edition of 1955 page 97
Year 1949 - Edition of 1956 page 87
Year 1950 - Edition of 1957 page 89
Year 1951 - Edition of 1959 page 89
Years 1952 to 1960 Edition of 1960 page 89

United States Primary Aluminum Production
U.S. Bureau of Mines Minerals Yearbook ("Aluminum" Preprints)
Years 1948 to 1949 - Edition of 1951, table 1, page 1
Years 1950 to 1954 - Edition of 1954, table 1, page 1
Years 1955 to 1959 - Edition of 1959, table 1, page 1

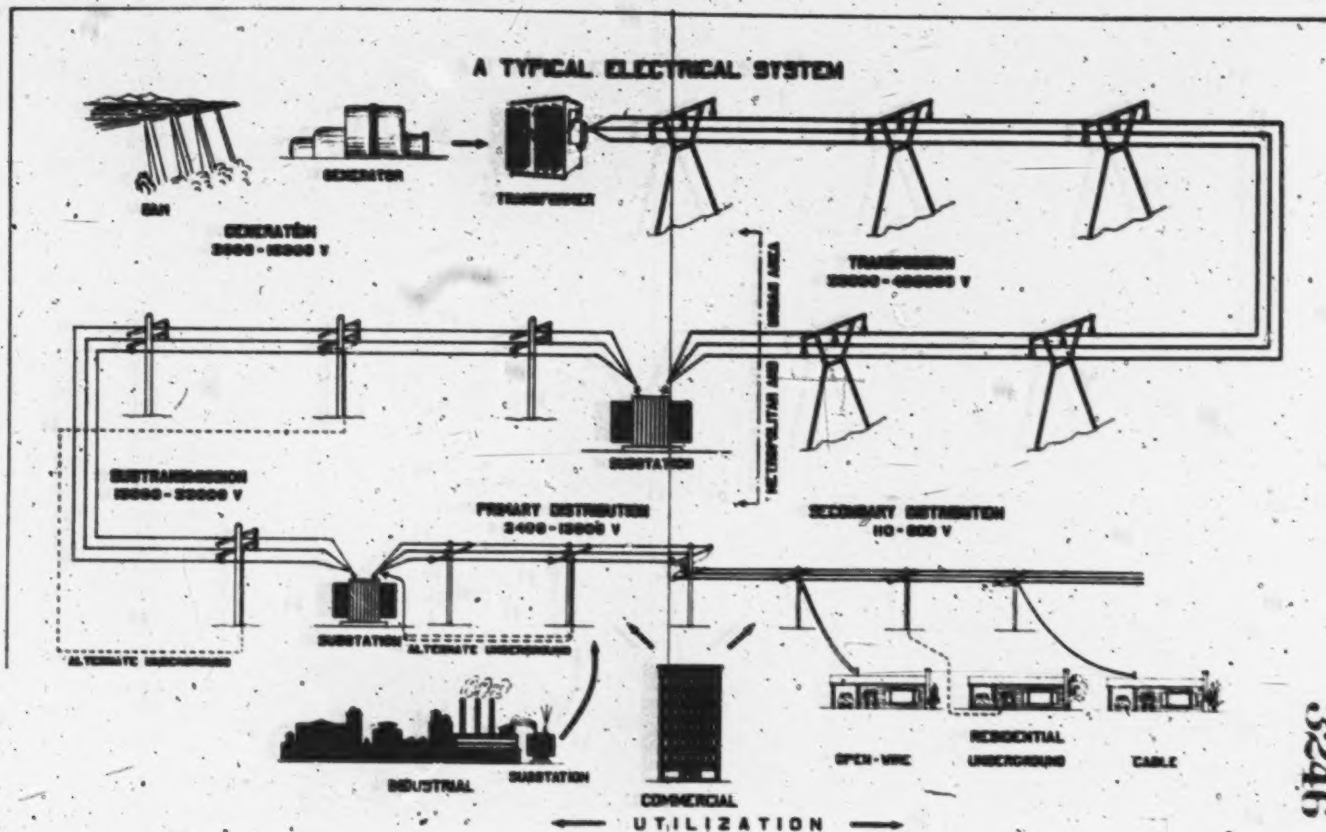
U.S. Bureau of Mines, Mineral Industry Surveys, Mineral Market Report
Year 1960 - Survey No. 3258, "Aluminum in 1960", table 4, page 4

United States Imports Crude Aluminum
American Metal Market "Metal Statistics" Handbook
Years 1948 to 1960 - Edition of 1961, page 583

Alcoa Primary Aluminum Capacity
American Metal Market Newspaper, issue dated 8/29/61

Alcoa Primary Aluminum Production
Compiled from Aluminum Stock Reports (company records)

Defendants' Exhibit 12



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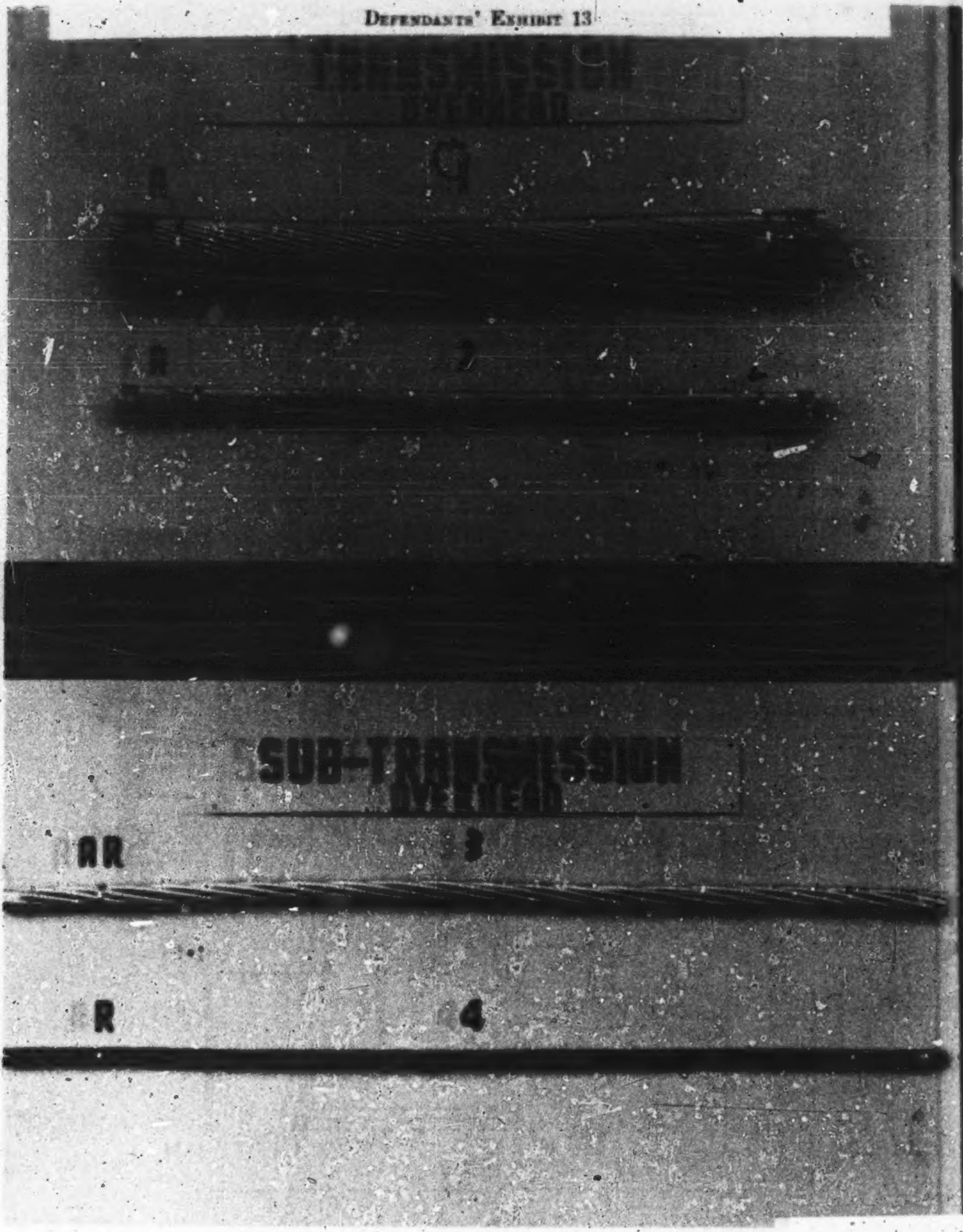
Defendants' Exhibit 13



[fol. 6440] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 13a

TRANSMISSION
OVERHEAD

A 1

1,275,000 CM Expanded ACSR Bare

A 2

336,400 CM 26/7 ACSR Bare

SUB-TRANSMISSION
OVERHEAD

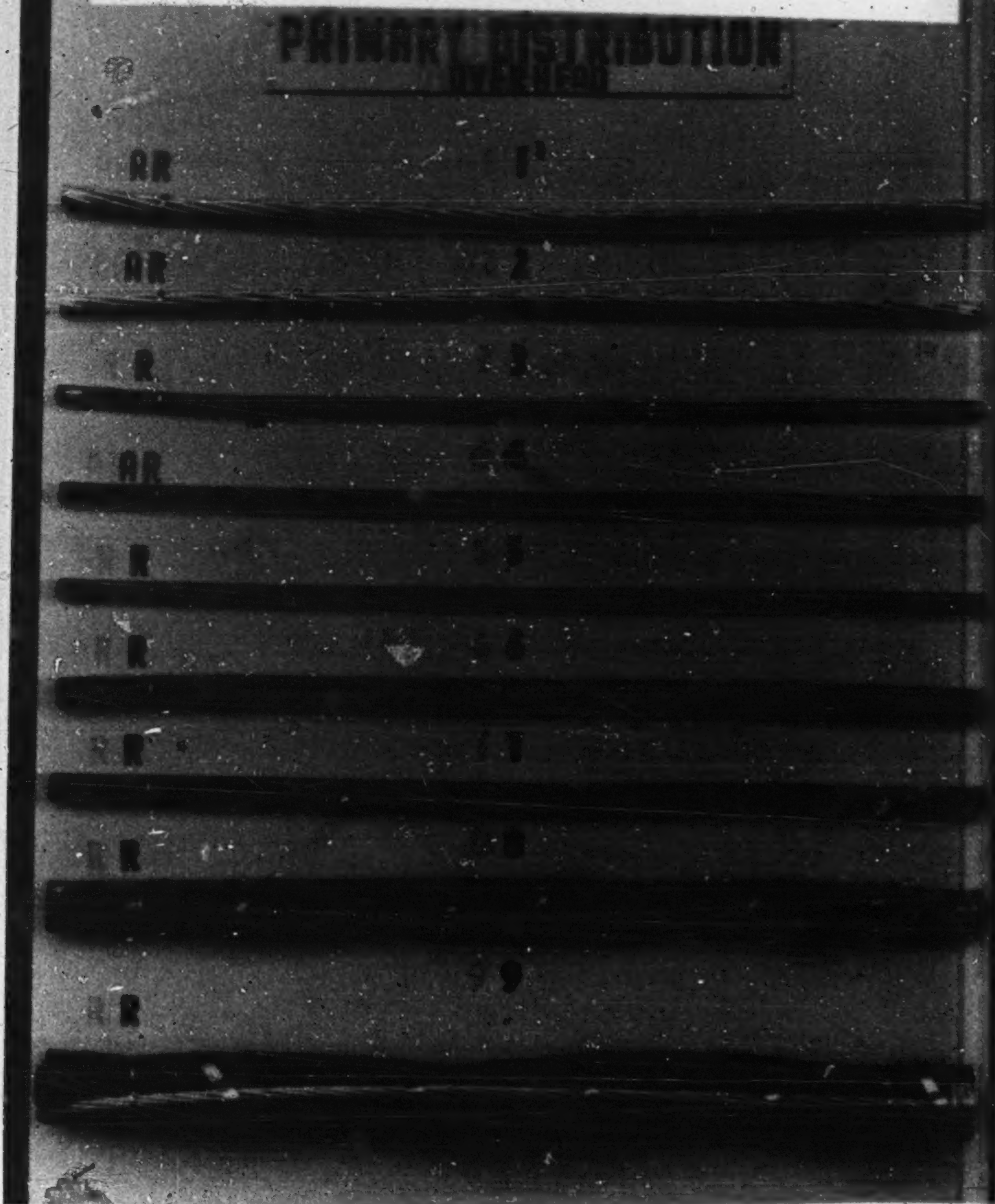
AR 3

4/0 AWG ACSR Bare

R 4

2/0 AWG Copper Hard Drawn Bare

Defendants' Exhibit 14



[fol. [illegible]2] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 14a

PRIMARY DISTRIBUTION
OVERHEAD

AR 1

4/0 AWG ACSR Bare Conductor

AR 2

4/0 AWG All Aluminum Bare Conductor

R 3

2/0 AWG Copper, Hard Drawn, Bare Conductor

AR 4

2/0 AWG ACSR, Polyethylene or Neoprene Covered Weatherproof (Line Wire)

R 5

2 AWG Copper H.D., Polyethylene Covered, Weatherproof (Line Wire)

R 6

2/0 AWG All Aluminum, Polyethylene Ins., Tree Wire

R 7

1 AWG Copper H.D., Polyethylene Ins., Tree Wire

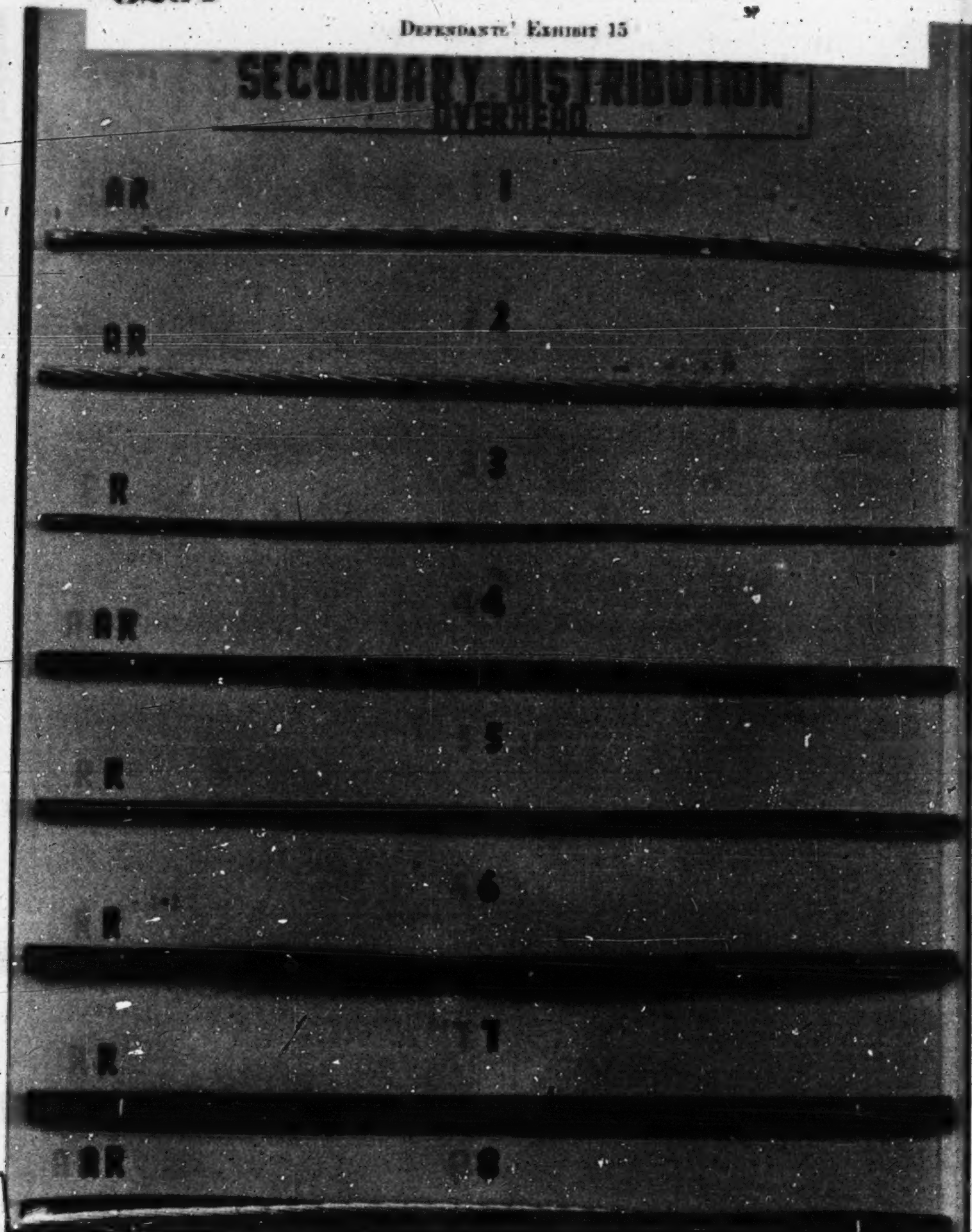
R 8

1 AWG Copper Self-Supporting Aerial Cable, 5 KV Rated

R 9

2/0 AWG Aluminum Self-Supporting Aerial Cable, 5 KV Rated

Defendants' Exhibit 15



[fol. 6444] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 15a

SECONDARY DISTRIBUTION
OVERHEAD

AR 1

1/0 AWG ACSR Bare Conductor

AR 2

1/0 AWG All-Aluminum Bare Conductor

R 3

2 AWG Hard Drawn Copper Bare Conductor

AR 4

1/0 AWG Aluminum-Polyethylene Covered Weatherproof (Line Wire)

R 5

2 AWG Copper-Polyethylene Covered Weatherproof (Line Wire)

R 6

2 AWG Copper-Neoprene Triplex Service Drop Cable

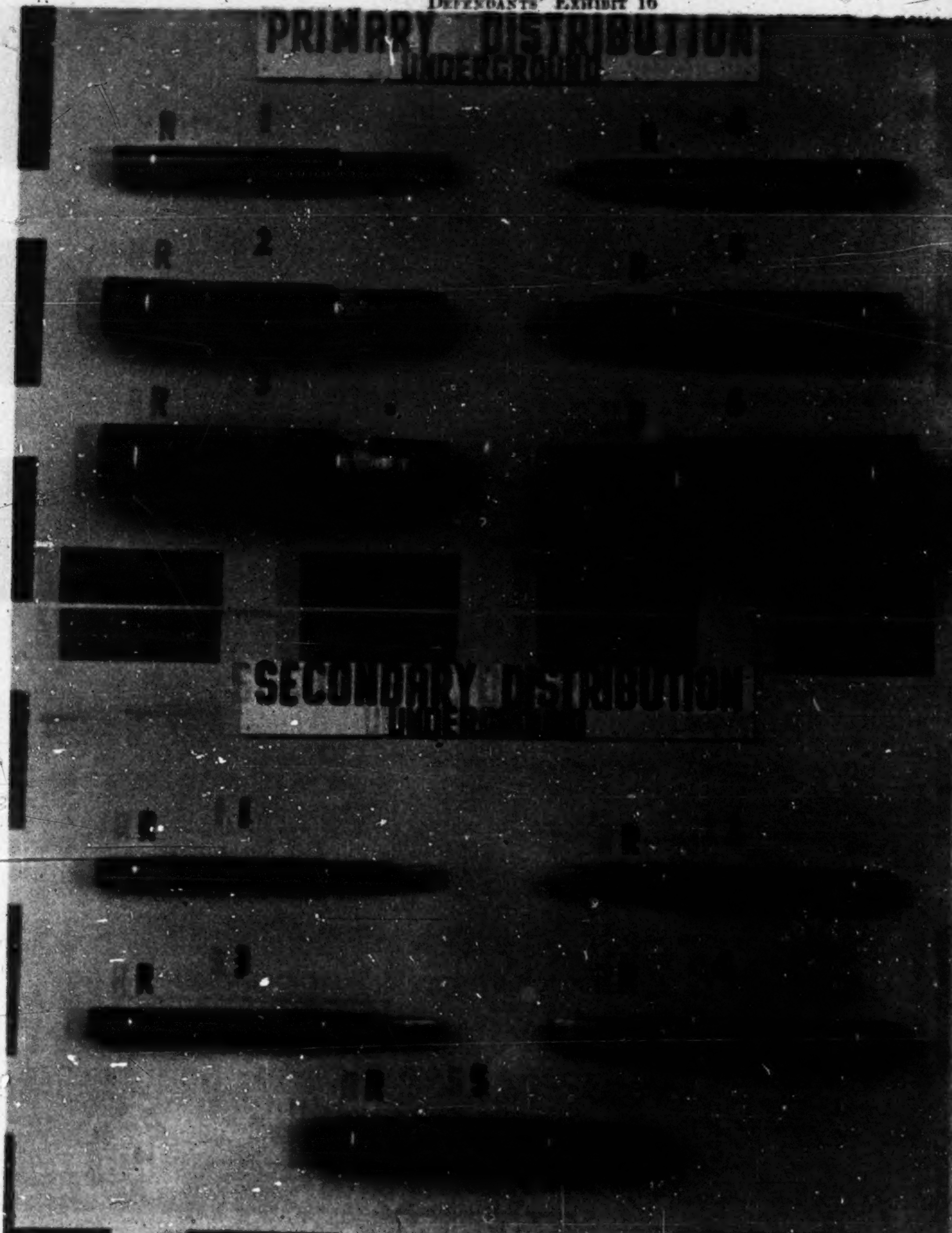
R 7

3/C #6 AWG Copper Service Drop Cable

AR 8

#2 AWG Aluminum-Polyethylene or Neoprene Triplex Service Drop Cable

Defendants' Exhibit 16



[fol. 6446] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 16a

PRIMARY DISTRIBUTION
UNDERGROUND

R 1

#2 AWG Copper, Polyethylene Ins.
Lead Sheath (15 KV Rated)

R 2

500 MCM Copper, Polyethylene Ins.
Shielded, PVC Jacket, (15 KV Rated)

R 3

400 MCM Copper Butyl Rubber Ins.
Shielded, Neoprene Jacket, (15 KV Rated)

R 4

#2 AWG Copper, Butyl Ins.
Concentric Serve (15 KV Rated)

R 5

500 MCM Copper, RoZone Ins. Neoprene Jacket
Unshielded, (5 KV Rated)

R 6

4/0 AWG Copper "RoZone" Ins.
Neoprene Sheath, 3/C Twisted
Neoprene Jacket, (5 KV Rated)

SECONDARY DISTRIBUTION
UNDERGROUND

R *1

2/0 AWG Copper
Style "RR" 600 V Rated

R *2

4/0 AWG Aluminum
Style RR 600 V. Rated

R *3

4/0 AWG Copper
Style RRD, 600 V. Rated

R *4

350 MCM Aluminum
Style RRD 600 V. Rated

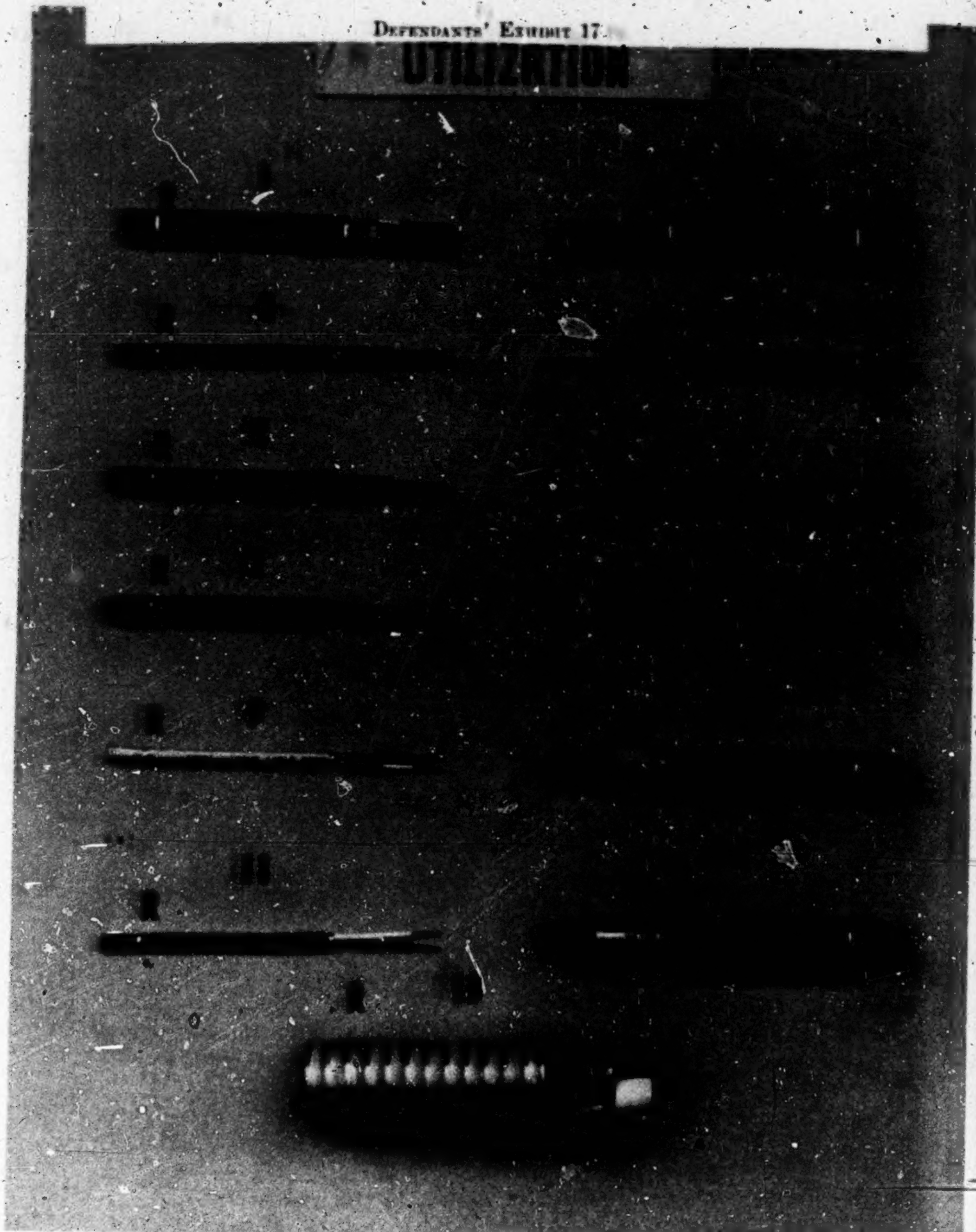
R *5

#2 AWG Copper
3/C Style RR 600 V. Rated

*NOTE: Above samples rubber insulated, Neoprene Jacketed.

[fol. 6447] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 17



[fol. 6448] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 17a

UTILIZATION

R 1

#4 AWG Copper 3/C Service Entrance Cable
Type S.E. Style U

R 2

#2 AWG Aluminum 3/C Service Entrance Cable
Type S.E. Style U

R 3

2 AWG Copper, Type TW
(Thermoplastic Insulated)
Building Wire 600V. Rated

R 4

1/0 AWG Aluminum Type TW
(Thermoplastic Insulated)
Building Wire 600V Rated

R 5

2 AWG Copper, Type USE
(Underground Service Entrance Cable)
600V. Rated

R 6

1/0 AWG Aluminum, Type USE
(Underground Service Entrance Cable)
600V. Rated

R 7

#14 AWG Copper, Portable Cord
3/C Type "SO" Rome "SO"

R 8

#2 AWG Copper Thermoplastic
Insulated Synthinol 901
Type TW Building Wire

R 9

12 AWG Copper, 2/C "RoFlex"
Non-Metallic Sheathed House Wiring Cable

R 10

#4/0 AWG Copper 600V.
Rated, Rubber and Lead Power Cable

R 11

12 AWG Copper, 2/C "Flexall"
Type UF Underground Feeder Cable

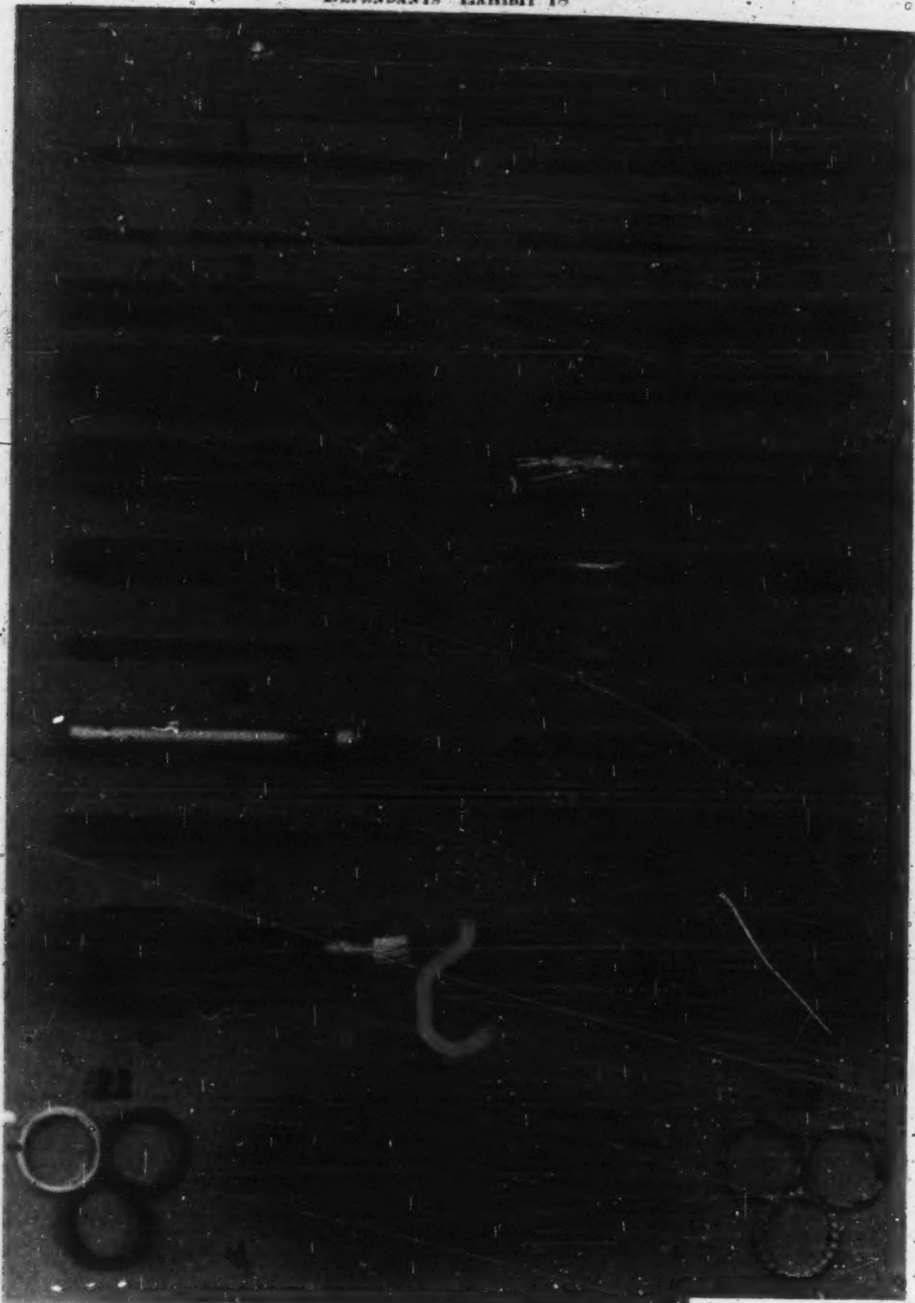
R 12

1/0 AWG Copper, 5 KV, Rated, Shielded
"RoZone-RoPrene" Power Cable

R 13

4/0 AWG Copper, 5KV Rated.
Interlocked Armored Power Cable

DEFENDANTS' EXHIBIT 18



Defendants' Exhibit 18a

OTHER REPRESENTATIVE ROME PRODUCTS

1

Rectangular Copper, Formvar Coated Magnet Wire

2

Rectangular Copper, Glass-Dacron Covered Magnet Wire

3

12 AWG Copper, 12/C Thermoplastic Insulated Control Cable

4

12 AWG Copper, Rubber Insulated Control Cable

5

10 AWG Copper, 10/C Special Missile Cable

6

1/0 AWG Copper, "Synthinol 901" (Thermoplastic) Transformer Lead Wire

7

Spiral 4 Communication Cable (U.S. Signal Corps)

8

MSCA-19 Shipboard Control Cable (Navy)

9

3/0 AWG Copper, "Rome-60" Welding Cable

10

Special Instrumentation Cable with Molded Connector

11

Rectangular Aluminum, Formvar Coated Magnet Wire

12

Rectangular Copper, Glass Covered Magnet Wire

13

22 AWG Copper, Thermoplastic Ins., Nylon Sheathed, Shielded, Thermoplastic Jacketed Instrumentation Cable

14

14 AWG Copper, "Rome-50" Portable Cord-Type SO

15

24 AWG Copper, 15 Quads, Thermoplastic Ins., Shielded, Thermoplastic Sheath Jacketed Instrumentation Cable

16

6 AWG Copper, Pole & Bracket Cable for Ornamental Street Lighting

17

8 AWG Copper, Series Street Lighting Cable

18

8 AWG Copper, "Figure-8" Multiple Street Lighting Cable

19

2 AWG Copper, "Rome-60" Mining Machine Cable

20

4 AWG Copper, 7/C Railway Signal Cable

21

4/0 AWG Copper, "Rome-60" Type SHD Dredge Cable

22

Radio Hookup Wire

23

Radio Hookup Wire

Defendants' Exhibit 19

DEFENDANTS' EXHIBIT 19a

SERVICE DROP CABLES

1. #4 AWG Std. Aluminum Triplex #6 ACSR Neutral
2. #4 AWG Std. Aluminum Triplex #4 Sol. Alumiweld Neutral
3. #4 AWG Std. Aluminum Triplex #4 Std. All Aluminum Neutral
4. #4 AWG Std. Aluminum Triplex #6 Std. Copperweld Neutral
5. #4 AWG Std. Aluminum Triplex #6 Sol. H.D. Copper Neutral

INSULATION
PLASTIC OR NEOPRENE

6. #6 AWG Std. Copper Triplex 8C Copperweld Neutral
7. #6 AWG Std. Copper Triplex 6 Sol. H.D. Bare Copper Neutral

INSULATION
PLASTIC OR NEOPRENE

8. #4 AWG Aluminum Style K (Ribbon Type)
9. #4 AWG Aluminum Style DD (Ribbon Type)
10. #4 AWG Aluminum Type S.D.
11. #6 AWG Copper Type S.D.
12. #4 AWG Sol. Copper Polyethylene Covered Weatherproof
13. #4 AWG Sol. Aluminum Neoprene Covered Weatherproof
14. #4 AWG Sol. Copper Fibrous Covered Weatherproof

CONDUCTOR
ALUMINUM OR COPPER

DEFENDANTS' EXHIBIT 20

[illegible]

[fol. 6454] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 20a

ALCOA-ROME

OVERLAP PRODUCTS

ACSR No. 6 to 4/0

AAC No. 8 to 1000 MCM

AL. Line Wire No. 6 to 1000 MCM

AL. Multiplex No. 6 to 4/0

Defendants' Exhibit 21

INSULATING MATERIALS

PAPER — IMPREGNATING COMPOUNDS — MINERAL OIL; SYNTHETIC OILS; ROSIN-SYNTHETIC RESINS

FIBROUS YARNS — COTTON, GLASS, SILK; RAYON, NYLON, ASBESTOS

VARNISHED MATERIALS — VARNISHED CAMBRIC; VARNISHED GLASS; VARNISHED PAPER; SYNTHETIC ENAMEL

RUBBER

PLASTICS

Defendants' Exhibit 22

INSULATING MATERIALS
THERMOPLASTIC

RESIN	TYPES	COMPOUNDING INGREDIENTS
POLYETHYLENE	HIGH MOLECULAR HIGH DENSITY IRRADIATED FLAME RETARDANT CELLULAR	CHLORINATED ORGANIC COMPOUNDS MINERAL OXIDES ANTIOXIDANTS U V ABSORBERS CARBON BLACK BLOWING AGENTS COLORS, RUBBER
POLYPROPYLENE	HIGH TEMPERATURE HIGH IMPACT CELLULAR	STABILIZERS, ANTI-OXIDANTS COLORS, FILLERS BLOWING AGENTS
POLYVINYL CHLORIDE POLYVINYL CHLORIDE-ACETATE COPOLYMERS	RIGID, SEMI-RIGID SEMI-CONDUCTING CELLULAR	PLASTICIZERS, STABILIZERS LUBRICANTS, FILLERS, FLAME RETARDANTS, COLORS
NYLON		HEAT & LIGHT STABILIZERS
CELLULOSE PLASTICS	ETHYL CELLULOSE CELLULOSE ACETATE CELLULOSE ACETATE-BUTYRATE	PLASTICIZERS, OTHER COMPOUNDING INGREDIENTS
TEFLON KEL-F		

DEFENDANTS' EXHIBIT 23

INSULATING MATERIALS
THERMOSETTING

RUBBER

NATURAL
POLYSULFIDE RUBBER
NEOPRENE RUBBER-TYPES GN-W, WD, WRT
GRS-SYNTHETIC RUBBER-TYPES 1018, 1019, 1023, 1801
BUTYL-SYNTHETIC RUBBER-TYPES 035, R100
SILICONE RUBBER
NITRILE-STYRENE RUBBER
HYPALON

ETHYLENE-PROPYLENE COPOLYMERS (EPR)
ETHYLENE PROPYLENE-DIENE TERPOLYMERS
STEREOSPECIFIC POLYMERS-CIS-4-POLYBUTADIENE

CROSS-LINKED POLYETHYLENE
POLYURETHANES

COMPOUNDING INGREDIENTS

ORGANIC ACCELERATORS
ORGANIC ANTIOXIDANTS
MINERAL OXIDES
CARBON BLACKS
WAXES
U V ABSORBERS
MINERAL INORGANIC EXTENDERS
ORGANIC EXTENDERS
MINERAL REINFORCING AGENTS
SULFUR & SULFUR COMPOUNDS
METALLIC VULCANIZING AGENTS
ORGANIC PEROXIDES

[fol. 6458] In United States District Court

Defendants' Exhibit 24

PROTECTIVE COVERINGS

METALLIC:

SHEATHING	LEAD, LEAD ALLOYS, ALUMINUM
ARMORING	STEEL OR BRONZE TAPE & WIRE, COPPER OR ALUMINUM TAPE & BRAIDED WIRE
COATINGS	ZINC, TIN, & LEAD ALLOYS

TREATED FIBERS:

BRAID	RAYON, COTTON, GLASS, ASBESTOS, JUTE, SISAL; NYLON, OTHER SYNTHETIC YARNS
TAPES OR WRAPS	COTTON, GLASS, JUTE, ASBESTOS
SATURATING-FINISHING COMPOUNDS	NATURAL & BY-PRODUCT ASPHALTS, ANIMAL & VEGETABLE PITCHES, MINERAL & VEGETABLE WAXES, OLEO-RESINOUS PAINTS & VARNISHES, SYNTHETIC RESIN BASE LACQUER

NON-METALLIC EXTRUDED

NATURAL & SYNTHETIC RUBBER

PLASTICIZED POLYVINYL CHLORIDE (PVC)

NYLON

POLYETHYLENE

POLYVINYL CHLORIDE-NITRILE RUBBER BLENDS

[fol. 6459] IN UNITED STATES DISTRICT COURT

DEFENDANT'S EXHIBIT 25

American Standard Specification for Weather-Resistant Wire and Cable, Neoprene Type

Sponsor Electrical Standards Board

Approved January 15, 1954

American Standards Association Incorporated

[fol. 6460] American Standard

Registered United States Patent Office

An American Standard implies a consensus of those substantially concerned with its scope and provisions. The consensus principle extends to the initiation of work under the procedure of the Association, to the method of work to be followed, and to the final approval of the standard.

An American Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American Standard does not in any respect preclude any party who has approved of the standard from manufacturing, selling, or using products, processes, or procedures not conforming to the standard.

An American Standard defines a product, process, or procedure with reference to one or more of the following: nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, certification, testing, and the service for which designed.

American Standards are subject to periodic review. They are reaffirmed or revised to meet changing economic conditions and technological progress. Users of American Standards are cautioned to secure the latest editions.

Producers of goods made in conformity with an American Standard are encouraged to state on their own responsibility, in advertising, promotion material, or on tags or labels, that the goods are produced in conformity with particular American Standards. The inclusion in such advertising and promotion media, or on tags or labels, of information concerning the characteristics covered by the standard to define its scope is also encouraged.

Published by American Standards Association,
Incorporated
70 East Forty-fifth Street
New York 17, N. Y.
Price, Fifty Cents

Universal Decimal Classification 621.315.336.7

[fol. 6461] Foreword

(This Foreword is not a part of the American Standard Specification for Weather-Resistant Wire and Cable, Neoprene Type, C8.34-1954.)

This American Standard is one of a series of standards on insulated wire and cable developed by ASA Sectional Committee, C8. The work of the technical subcommittee, in preparing this standard, extended over a period of three years. It was recognized that after a year or two of experience in production and usage there undoubtedly would be additional suggestions as to changes which should be made; however, it was felt that the specification could only be developed by bringing it into commercial usage by issuing it as an American Standard.

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to the American Standards Association, Incorporated, 70 East Forty-fifth Street, New York 17, N. Y.

The organizations which participated in this work and the names of their representatives, as listed at the time this standard was submitted to the Sectional Committee for approval, are as follows:

W. F. Davidson, *Chairman* S. D. Hoffman, *Secretary*

Organization Represented	Name of Representative
American Institute of Electrical Engineers	W. F. Davidson
	W. A. Del Mar
	L. C. Peterman
	W. N. Zippler
American Society for Testing Materials	Carl E. Ambelang
	R. W. Chadbourn
	A. A. Jones
	Gordon Thompson
Anaconda Wire and Cable Company	L. L. Carter
Armed Services Electro Standards Agency (Liaison)	David Raskin
Association of American Railroads	
Engineering Division, Signal Section	W. W. Beard
Engineering Division, Electrical Section	C. R. Troop
Mechanical Division, Electrical Section	C. R. Troop
Association of Iron and Steel Engineers	F. W. Cramer
Electric Light and Power Group	G. E. Dean
	J. H. Foote
	H. Halperin
	C. T. Sinclair
	C. K. Poarch (Alt)
Insulated Power Cable Engineers Association	E. W. Davis
	W. J. Richard
	R. J. Wiseman

Organization Represented	Name of Representative
International Municipal Signal Association	F. Leewe W. S. Anderson (Alt)
National Board of Fire Underwriters	E. N. Davis
National Bureau of Standards, U. S. Department of Commerce	L. E. Barbrow
National Electrical Manufacturers Association	C. A. Finkel C. O. Hull K. M. MacKay R. A. Schatzel H. H. Weber C. W. Zimmerer
National Fire Protection Association	C. C. Lawson
Telephone Group	Nathan Tunison
U. S. Department of the Army (Liaison)	Code 350
U. S. Department of the Navy, Bureau of Ships	Laboratory Officer, Material Laboratory, New York Navy Yard (Alt)

Technical Committee No. 12 on Weatherproof Wire and Cable, which was responsbile for the development of this standard, has the following personnel:

C. T. Sinclair, Chairman

C. E. Ambelang
B. J. Barmack
W. W. Beard
H. N. Bockus
L. L. Carter
Glen A. Coan
G. E. Dean
E. P. Hall
B. R. Hubbard
T. S. Johnson
C. A. Jordan
J. J. Morrison
R. A. Schatzel
E. G. Sturdevant
J. A. Ten Brock
C. E. Topping
G. W. Zink

[fol. 6462]

Contents

[fol. 6463] American Standard Specification for Weather-Resistant Wire and Cable, *Neoprene Type* *

1. Scope

1.1 These specifications cover neoprene-type weather-resistant wire and cable, the conductors, the materials used for the neoprene coverings, and the acceptance requirements.

2. Conductors

2.1 Copper Conductors. The copper conductors of finished wire and cable shall be in accordance with the following American Standards, or the latest revisions thereof approved by the American Standards Association, Incorporated, except as modified herein.

American Standard Specifications for Soft or Annealed Copper Wire, C7.1-1953, 2nd ed. (ASTM B 3-53T)
American Standard Specifications for Hard-Drawn Copper Wire, C7.2-1953, 2nd ed. (ASTM B 1-53T)
American Standard Specifications for Medium-Hard-Drawn Copper Wire, C7.3-1953 (ASTM B 2-52)
American Standard Specifications for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, C7.8-1953, 2nd ed. (ASTM B 8-53)

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* Note: These specifications are the result of cooperative effort among members of ASA Technical Committee 12, the producer of the neoprene polymer, and the several wire and cable manufacturers who are producers of neoprene weather-resistant wire. These specifications are regarded as tentative, since the work of the Committee and those co-operating with it is continuing with a view toward (1) the further development of test methods and specification requirements that will assure furnishing the most desirable type of neoprene compound from the standpoint of service characteristics, and (2) the development of reasonable and desirable methods for assuring the continuity of covering of the finished weather-resistant wire.

Field and manufacturing experience is expected to provide further guidance as to optimum thickness of covering and the most suitable limits for the physical properties of the conductor after weatherproofing.

2.1.1 For completed copper conductors after covering, minimum tensile or breaking-strength limits shall be 5 percent less, and maximum tensile or breaking-strength limits shall be 5 percent greater than the limits specified in the applicable referenced specifications. The minimum elongation limits for annealed solid wires or annealed wires removed from stranded conductors after covering shall be numerically 5 percentage points less than the minimum elongation required for bare conductors (for example, 30 percent reduced to 25 percent). The minimum elongation limits for hard-drawn and medium-hard-drawn solid wires after covering likewise shall be reduced 0.10 percent in numerical value for sizes No. 4 AWG and smaller, and 0.20 percent for sizes larger than No. 4 AWG. No elongation test shall be required on component wires of stranded hard-drawn and medium-hard-drawn copper conductors after covering.

2.2 Copper-Alloy Conductors. The copper-alloy (bronze) conductors of finished wire shall be of Grade-30 alloy, and shall be in accordance with American Standard Specifications for Hard-Drawn Copper Alloy Wires for Electrical Conductors C7.10-1953, 2nd ed. (ASTM B 105-53), or the latest revision thereof approved by the American Standards Association, Incorporated, except as modified herein.

2.2.1 For completed Grade-30 alloy wires after covering, minimum tensile-strength limits shall be 5 percent less, and minimum elongation limits shall be numerically 0.10 percentage points less than the respective limits specified in the above-referenced bare-wire specifications.

2.2.2 These specifications are not intended to cover solid copper-alloy conductors larger than No. 4 AWG or stranded copper-alloy conductors.

2.3 Copper-Covered Steel Conductors. The copper-covered steel conductors of finished wire shall be either Grade-30 high strength or Grade-40 high strength, as specified by the purchaser, and shall be in accordance with American Standard Specifications for Hard-Drawn Copper Covered Steel Wire, C7.17-1953 (ASTM B 227-52), or the latest revision thereof approved by the American Standards Association, Incorporated.

2.4 Aluminum Conductors. The aluminum conductors of finished wire and cable shall be in accordance with the following specifications, or the latest revisions thereof approved by the American Standards Association, Incorporated, except as modified herein:

[fol. 6464] American Standard Specifications for Hard-Drawn Aluminum Wire for Electrical Purposes, C7.20-1953, 2nd ed. (ASTM B 230-53T)

American Standard Specifications for Concentric-Lay-Stranded Aluminum Conductors, Hard-Drawn, C 7.21-1953, 2nd ed. (ASTM B 231-53)

2.4.1 For completed aluminum conductors after covering, minimum tensile or breaking-strength limits shall be 10 percent less than the limits specified in the applicable referenced bare-conductor specifications. The minimum elongation limits for solid hard-drawn aluminum wires after covering shall be numerically 0.5 percentage points less than the minimum elongation required by the applicable bare-wire specification. No elongation test shall be required on component wires of stranded hard-drawn aluminum conductors after covering.

2.5 ACSR. Prior to covering, aluminum conductors, steel-reinforced, shall be in accordance with American Standard Specifications for Concentric-Lay-Stranded Aluminum Conductors, Steel-Reinforced (ACSR), C7.22-1953, 2nd ed. (ASTM B 232-53T), or the latest revision thereof approved by the American Standards Association, Incorporated.

2.5.1 Tensile or elongation tests shall not normally be required on completed ACSR or its component wires after covering; however, upon advance agreement between manufacturer and purchaser, breaking-strength tests may be made upon completed ACSR with covering removed. For such tests, compression or other suitable fittings shall be employed.

2.5.2 For purposes of rating, the breaking strength of finished ACSR after covering shall be taken as 95 percent of the bare-conductor breaking strength specified in 8(a) of American Standard Specifications for Concentric-Lay-Stranded Aluminum Conductors, Steel-Reinforced (ACSR),

C7.22-1953, 2nd ed. (ASTM B 232-53T). If ACSR is tested in accordance with advance mutual agreement between manufacturer and purchaser, its breaking strength after covering shall be not less than 95 percent of the bare-conductor breaking strength specified in 8(b) of the same specification.

3. Neoprene Covering

The covering shall be neoprene (polychloroprene) so compounded and vulcanized as to meet the following requirements. The compound shall contain suitable amounts of well-dispersed channel black and anti-oxidants to insure long life as a line-wire covering in direct contact with metallic conductors.

3.1 Physical Requirements. The covering shall conform to the following requirements when tested in accordance with American Society for Testing Materials Tentative Methods of Testing Rubber Insulated Wire and Cable (ASTM D 470-52T).

Initial tensile strength, minimum, psi	1400
Initial elongation at rupture, minimum, percent	250
Set in 2-inch gage length, maximum, inch	3/8
Oxygen-pressure aging test (96 hrs at 70C and 300 psi)	
Tensile strength, minimum, percent of original	75
Elongation, minimum, percent of original	65
Oil-Immersion test (18 hrs at 121C)	
Tensile strength, minimum, percent of original	60
Elongation, minimum, percent of original	60

4. Acceptance Requirements

The finished wire or cable shall meet the following acceptance requirements. The frequency of sampling to determine compliance with these requirements shall be in accordance with 5, Samples for Test, and conformance with these requirements shall be in accordance with 9, Acceptance or Rejection.

4.1 Conductor Tests. Tests on conductors of other than ACSR construction shall be made upon finished wire or

cable after removing the covering. Tests and properties shall conform to the requirements of 2, Conductors.

4.2 Thickness of Covering. The average thickness of the covering, considered as one-half the difference between the average over-all diameter measured over the covering, and the diameter of the bare conductor, shall be not less than that shown in Tables 1 or 2. The minimum thickness at any point shall be not more than 5 mils below the specified average for thickness 3/64 inch and under, and not more than 10 percent below the specified average for 4/64 inch and over.

4.3 Weights and Tolerances

4.3.1 The diameters of the conductors of finished wire or the individual strands of stranded conductors in finished cable supplied under these specifications shall meet the requirements and limits of 2, Con-

[fol. 6465]

Table 1

Nominal Weights of Weather-Resistant Wire and Cable Neoprene Type

(Pounds per 1000 Feet)

Size AWG or Mcm	Conductors Weights: Copper & Copper Alloy	Aluminum	Copper-Covered Steel	Coverings: Thickness 64ths in.	Weight	Finished Wire and Cable: Copper & Copper Alloy	Aluminum	Copper-Covered Steel
Stranded Conductors								
500	1544	469.4	——	6	215	1759	684	——
477	——	447.8	——	6	211	——	659	——
450	1389	422.4	——	6	204	1593	626	——
400	1235	375.5	——	6	203	1438	579	——
397.5	——	373.0	——	6	202.4	——	575	——
350	1081	328.6	——	5	159	1240	488	——
336.4	——	315.7	——	5	156.0	——	472	——
300	926.3	281.6	——	5	146.7	1073	428	——
266.8	——	250.4	——	5	137.5	——	388	——
250	771.9	234.7	——	5	133.1	905	368	——
4/0	653.3	198.6	——	4	107.7	761	306	——
3/0	518.1	157.5	——	4	93.9	612	251	——
2/0	410.9	124.9	——	4	83.1	494	208	——
1/0	325.8	99.1	——	4	72.2	398	171	——
1	258.4	78.6	——	4	64.6	323	143	——
2	204.9	62.3	——	3	43.0	248	105	——
4	128.9	39.2	——	3	34.1	163	73.3	——
6	81.1	24.6	——	3	26.9	108	51.5	——
Solid Conductors								
1	253.3	——	——	4	47.7	301	——	——
2	200.9	61.1	——	3	31.1	232	92.2	——
3	159.3	——	——	3	28.7	188	——	——
4	126.4	38.4	115.8	3	25.6	152	64.0	141
6	79.5	24.2	72.8	3	21.5	101	45.7	94.3
8	50.0	15.2	45.8	3	18.0	68	33.2	63.8
9	39.6	——	36.3	3	16.4	56	——	52.7
10	31.4	——	28.8	2	9.2	40.6	——	38.0
12	19.8	——	18.1	2	7.7	27.5	——	25.8

[fol. 6466]

Table 2

Nominal Weights of Weather-Resistant Wire and Cable, Neoprene Type

ACSR Conductors
(Pounds per 1000 Feet)

	Conductors			Covering		
Size*	Hard-Drawn Copper Equivalent†	Stranding Aluminum/Steel	Weight	Thickness	Weight	Finished Wire and Cable
AWG	AWG			64ths in.		
4/0	2/0	6/1	291.1	4	117.9	409
3/0	1/0	6/1	230.8	4	103.2	334
2/0	1	6/1	183.1	4	89.9	273
1/0	2	6/1	145.2	4	78.8	224
1	3	6/1	115.2	4	69.8	185
2	4	7/1	106.7	3	48.3	155
2	4	6/1	91.3	3	47.7	139
3	5	6/1	72.4	3	41.6	114
4	6	7/1	67.0	3	38.0	105
4	6	6/1	57.4	3	37.1	94.5
5	7	6/1	45.5	3	33.0	78.5
6	8	6/1	36.1	3	28.9	65.0

* Aluminum wires only.

† Area of hard-drawn copper cable (conductivity = 97 percent IACS) having the same d-c resistance as that of the ACSR (aluminum conductivity = 61 percent IACS).

ductors, and the variation in weights from Tables 1 and 2 shall be determined by the dimensional tolerances of 2, Conductors.

4.3.2 The average weight of the covering of wire or cable in any lot or shipment of any one size or type manufactured or supplied under these specifications shall vary not more than 15 percent over or 15 percent under the nominal weights given in Tables 1 and 2. This average applies to the entire lot or shipment and is not cause for rejection of an individual coil or reel exceeding the 15-percent variation. Each sample used for this test shall be not less than 2 feet in length for sizes 4/0 AWG and smaller, and not less than 1 foot in length for 250,000 cm and larger.

4.3.3 The weights of finished wire and cable in Tables 1 and 2 are presented merely as a matter of information for the convenience of the user of these specifications, and are subject to the tolerances resulting from the application of 4.3.1 and 4.3.2.

5. Samples for Test

Samples to determine conformance with Acceptance Requirements, 4, shall be taken as prescribed in the following paragraphs:

5.1 Cutting. Fair samples shall be cut from the ends of coils or reels, after first cutting back these ends at least 2 feet. These samples shall be cut in half and tagged—one-half to be used for the tests, the other half to be held in reserve for check tests. The samples shall not be distorted or sharply bent.

5.2 Number. The number of samples of each size of wire or cable taken for test shall be as follows:

[fol. 6467] *5.2.1 Wire or Cable Supplied in Coils*

(*a*) For coils of standard size exceeding 1000 feet of wire or cable, samples shall be taken from three coils of the first lot of 25 coils or fraction thereof, and samples from one coil of each additional 25 coils or fraction thereof.

(*b*) For small coils of less than 1000 feet of wire or cable, samples shall be taken from three coils of the first lot of 2500 pounds or fraction thereof and samples from one coil of each additional 2500-pound lot or fraction thereof.

(*c*) If less than three coils are submitted, one sample shall be taken from each coil.

5.2.2 Wire or Cable Supplied on Reels

(*a*) For reels of standard size containing 2000 feet or more of wire or cable, samples shall be taken from three of the first lot of 30 reels or fraction thereof, and samples from one of each additional lot of ten reels or fraction thereof.

(*b*) For small reels of less than 2000 feet of wire or cable, samples shall be taken from three reels of the first lot of 6000 pounds or fraction thereof, and samples from one reel of each additional 2000 pound lot or fraction thereof.

(*c*) If less than three reels are submitted, one sample shall be taken from each reel.

6. Identification

6.1 The wire shall be so identified that the manufacturer can be determined readily.

7. Packing and Marking

7.1 Packing and marking shall be in accordance with the purchaser's specification.

8. Inspection

8.1 Inspection and acceptance shall be made at the point of manufacture. The manufacturer shall give the purchaser, or his representative, such access to his works during working hours as is reasonable and necessary to determine the suitability of the material to be supplied and shall furnish the necessary apparatus, labor, and other facilities for making the inspection and acceptance tests herein called for, without cost to the purchaser. Neither inspection, waiving of inspection, nor the purchaser's acceptance shall relieve the manufacturer from obligation to furnish weather-resistant wire in accordance with these specifications.

9. Acceptance or Rejection

9.1 Conformance with these specifications shall be determined as follows:

(*a*) If 20 percent or more of the samples fail to meet these specifications, an entirely new lot of samples shall be selected at random from the shipment and tested. If the second group of samples fails to meet these specifications, as outlined in the preceding sentence, the entire shipment shall be rejected.

(*b*) The 15-percent variation in the average weight of the complete covering shown in 4.3 establishes a manufacturing tolerance. Should any shipment of wire or cable exceed this manufacturing tolerance by weight, but be satisfactory in all other respects, the purchaser may accept the shipment, but he shall not be required to pay for weather-resistant covering in excess of the allowable variation, and he shall receive credit from the manufacturer for such excess over the maximum permissible

weight of covering, at the price charged for the finished wire or cable.

(*c*) In all cases, even if the shipment of wire or cable is accepted, the coils or reels that fail to meet these specifications shall be rejected, except that individual coils or reels shall not be rejected because covering weights exceed the allowable variation, when the average weight of the entire lot is within the allowable variation or when the customer elects to accept an entire lot or shipment in which the average weight exceeds the allowable variation.

[fol. 6468] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 26

American Standard Specifications for Weather-Resistant Wire and Cable, Polyethylene Type

Sponsor Electrical Standards Board

Approved August 13, 1957
American Standards Association
Incorporated

[fol. 6469] American Standard

Registered United States Patent Office

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An American Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American Standard does not in any respect preclude any party who has approved of the standard from manufacturing, selling, or using products, processes, or procedures not conforming to the standard.

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Published by American Standards Association,
Incorporated
70 East Forty-fifth Street
New York 17, N. Y.
Price, Seventy-five Cents

Universal Decimal Classification 621.315.336.9

[fol. 6470]

Foreword

(This Foreword is not a part of American Standard Specifications for Weather-Resistant Wire and Cable, Polyethylene Type, C8.35-1957.)

This American Standard is one of a series of standards on insulated wire and cable developed by ASA Sectional Committee C8. The work of technical subcommittee 12, in preparing this standard, extended over a period of many years. This standard is the result of the cooperative effort between the producers of polyethylene and the several wire and cable manufacturers who are producers of polyethylene weather-resistant wire.

The committee is continuing its efforts with a view towards (1) the further development of test methods and specification requirements that will assure furnishing the most desirable type of polyethylene compound from the standpoint of service characteristics, and (2) the development of reasonable and desirable methods for assuring the continuity of covering of the finished weather-resistant wire.

Field and manufacturing experience is expected to provide further guidance as to optimum thicknesses of covering and the most suitable limits for the physical properties of the conductor after covering.

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to the American Standards Association, Incorporated, 70 East Forty-fifth Street, New York 17, N. Y.

The organizations which participated in this work and the names of their representatives, as listed at the time this standard was submitted to the Sectional Committee for approval, are as follows:

C. T. Hatcher, Chairman   M. A. Pisciotta, Secretary

Organization Represented	Name of Representative
American Institute of Electrical Engineers	A. F. Corry W. A. Del Mar L. C. Peterman W. N. Zippler
American Society for Testing Materials	Carl E. Ambelang A. A. Jones R. A. Schatzel Gordon Thompson

Organization Represented	Name of Representative
ASA Sectional Committee C76 (Liaison)	T. F. Brandt
Anaconda Wire and Cable Company	L. L. Carter
Armed Services Electro-Standards Agency (Liaison)	I. L. Rosenheim
Association of American Railroads	
Engineering Division, Electrical Section	C. R. Troop
Engineering Division, Signal Section	R. W. Margah
Mechanical Division, Electrical Section	C. R. Troop
Association of Iron and Steel Engineers	C. G. Dimitt
Electric Light and Power Group	G. E. Dean
	J. H. Foote
	H. Halperin
	M. H. Pratt
	R. C. Blankenburg (Alt)
	C. K. Poarch (Alt)
Insulated Power Cable Engineers Association	W. J. Richard
	S. J. Rosch
	R. J. Wiseman
International Municipal Signal Association, Incorporated	F. Leewe
	W. S. Anderson (Alt)

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Organization Represented	Name of Representative
National Board of Fire Underwriters	E. N. Davis
National Bureau of Standards, U. S. Department of Commerce	R. F. Tener
National Electrical Manufacturers Association	G. J. Crowdes
	C. O. Hull
	W. J. Richard
	R. A. Schatzel
	H. H. Weber
National Fire Protection Association	C. W. Zimmerer
Telephone Group	C. C. Lawson
Underwriters' Laboratories, Inc.	C. W. Zimmerer
	E. N. Davis (Alt)
U. S. Department of the Navy, Bureau of Ships	Code 350
Member-at-Large	C. T. Hatcher

Technical Committee 12 on Weatherproof Wire and Cable, which was responsible for the development of this standard, has the following personnel:

B. R. Nevins, Chairman

C. E. Ambelang	B. R. Hubbard	R. A. Schatzel
L. L. Carter	C. A. Jordan	T. P. Sharples
G. E. Dean	C. C. Lawson	J. G. Stranch
E. C. De Beane	R. W. Margah	E. G. Sturdevant
E. G. Driscoll	G. H. Olney	C. E. Topping
E. J. Holcomb	E. M. Paschall	

[fol. 6472] Contents

[fol. 6473] American Standard Specifications for Weather-Resistant Wire and Cable, Polyethylene Type

1. Scope

1.1 These specifications cover polyethylene-type weather-resistant wire and cable, the conductors, the materials used for the polyethylene coverings, and the acceptance requirements.

2. Conductors

2.1 Copper Conductors. The copper conductors of finished wire and cable shall be in accordance with the following American Standards, or the latest revisions thereof approved by the American Standards Association, Incorporated, except as modified herein.

American Standard Specifications for Soft or Annealed Copper Wire, C7.1-1955 (ASTM B 3-54T)

American Standard Specifications for Hard-Drawn Copper Wire, C7.2-1953, R1957 (ASTM B 1-56T)

American Standard Specifications for Medium-Hard-Drawn Copper Wire, C7.3-1953 (ASTM B 2-52)

American Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft, C7.8-1953 (ASTM B 8-53)

2.1.1 For completed copper conductors after covering, minimum tensile or breaking-strength limits shall be 5 percent less, and maximum tensile or breaking-strength limits shall be 5 percent greater than the limits specified in the applicable referenced specifications. The minimum elongation limits for annealed solid wires or annealed wires removed from stranded conductors after covering shall be numerically 5 per cent less than the minimum elongation required for bare conductors (for example, 30 percent reduced to 25 percent). The minimum elongation limits for hard-drawn and medium-hard-drawn solid wires after covering likewise shall be reduced in numerical value 0.10 percent for sizes No. 4 AWG and smaller, and 0.20

percent for sizes larger than No. 4. No elongation test shall be required on component wires of stranded hard-drawn and medium-hard-drawn copper conductors after covering.

2.2 Copper-Alloy Conductors. The copper-alloy (bronze) conductors of finished wire shall be Alloy No. 30 and shall be in accordance with American Standard Specifications for Hard-Drawn Copper Alloy Wires for Electrical Conductors, C7.10-1956 (ASTM B 105-55), or the latest revision thereof approved by the American Standards Association, Incorporated, except as modified herein.

2.2.1 For completed Alloy No. 30 wires after covering, minimum tensile-strength limits shall be numerically 5 percent less, and minimum elongation limits shall be numerically 0.10 percent less, than the respective limits specified in the above-reference bare-wire specification.

2.2.2 These specifications are not intended to cover solid copper-alloy conductors larger than No. 4 AWG or stranded copper-alloy conductors.

2.3 Copper-Covered Steel Conductors. The copper-covered steel conductors of finished wire shall be either Grade-30 high strength, or Grade-40 high strength as specified by the purchaser, and shall be in accordance with American Standard Specifications for Hard-Drawn Copper Covered Steel Wire, C7.17-1953 (ASTM B 227-52), or the latest revision thereof approved by the American Standards Association, Incorporated:

2.4 Aluminum Conductors. The aluminum conductors of finished wire and cable shall be in accordance with the following American Standards, or the latest revisions thereof approved by the American Standards Association, Incorporated, except as modified herein.

American Standard Specifications for Hard-Drawn Aluminum Wire for Electrical Purposes, C7.20-1956 (ASTM B 230-55T).

American Standard Specifications for Concentric-Lay-Stranded Aluminum Conductors, Hard-Drawn and Three-Quarter Hard-Drawn, C7.21-1956 (ASTM B 231-55)

2.4.1 For completed aluminum conductors after covering, minimum tensile or breaking-strength limits shall be 10 percent less than the limits specified in the applicable [fol. 6474] referenced bare-conductor specifications. The minimum elongation limits for solid hard-drawn aluminum wires after covering shall be numerically 0.5 percent less than the minimum elongation required by the applicable bare-wire specification. No elongation test shall be required on component wires of stranded hard-drawn aluminum conductors after covering.

2.5 ACSR. Prior to covering, aluminum conductors, steel-reinforced, shall be in accordance with American Standard Specifications for Concentric-Lay-Stranded Aluminum Conductors, Steel-Reinforced (ACSR), C7.22-1956 (ASTM B 232-55T), or the latest revision thereof approved by the American Standards Association, Incorporated.

2.5.1 Tensile or elongation tests shall not normally be required on completed ACSR or its component wires after covering. However, upon advance agreement between manufacturer and purchaser, breaking-strength tests may be made on completed ACSR with covering removed. For such tests, compression or other suitable fittings shall be employed.

2.5.2 For purposes of rating, the breaking strength of finished ACSR after covering shall be taken as 95 percent of the bare-conductor breaking strength specified in Section 8(a) of American Standard C.722-1956 (ASTM B 232-55T). If ACSR is tested in accordance with advance mutual agreement between manufacturer and purchaser, the breaking strength of ACSR after covering shall be not less than 95 percent of the bare-conductor breaking strength specified in Section 8(b) of that same specification.

3. Polyethylene Covering

The covering shall be extruded polyethylene compound containing only properly dispersed suitable carbon black and heat stabilizer and meeting the following physical and chemical requirements:

3.1 Carbon Black. The polyethylene compound on the finished wire or cable shall contain 3.0 percent ± 0.5 per-

cent by weight of medium-color channel black having a maximum particle size of 20 millimicrons (mμ). The absorptivity as determined by the method prescribed in Appendix A shall not be less than 24,000 when measured using light of wave-length 560 mμ, except that for an integrating sphere photometer "white light" (color temperature = 2850 K) shall be used.

3.2 Heat Stabilizer. To insure thermal stability during processing, the polyethylene compound shall contain a suitable antioxidant.

3.3 Specific Gravity. The polyethylene compound on the finished wire or cable shall have a specific gravity of 0.91 to 0.94 as determined by ASTM D 792-50, Standard Methods of Test for Specific Gravity of Plastics.

3.4 Flow Rate. The flow rate of the polyethylene compound on the finished wire or cable shall be such that the melt index shall not exceed 2.1 grams per 10 minutes as determined by ASTM D 1238-52T, Tentative Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer.

3.5 Tensile Properties. The polyethylene compound removed from the finished wire or cable shall have a tensile strength of not less than 1200 pounds per square inch (psi) and an ultimate elongation at rupture, including cold drawing, of not less than 300 percent when tested in accordance with ASTM D 470-54T, Tentative Methods of Testing Rubber and Thermoplastic Insulated Wire and Cable, except that the gage marks shall be 1 inch apart.

3.6 Weights and Covering Thicknesses. The weights and covering thicknesses shall be those prescribed in Section 4, Acceptance Requirements.

4. Acceptance Requirements

The finished wire or cable shall meet the following acceptance requirements. The frequency of sampling to determine compliance with these requirements shall be in accordance with Section 5, Samples for Test, and conformance with these requirements shall be in accordance with Section 9, Acceptance or Rejection.

4.1 Conductor Tests. Tests on conductors of other than ACSR construction shall be made upon finished wire or cable after removing the covering. Tests and properties shall conform to the requirements of Section 2, Conductors.

4.2 Thickness of Covering. The average thickness of the covering, considered as one-half the difference between the ~~average over-all diameter~~ measured over the covering and the diameter of the bare conductor, shall be not less than that shown in Tables 1 or 2. The minimum thickness at any point shall not be more than 5 mils below the specified average for thicknesses $\frac{3}{64}$ inch and under, and not more than 10 percent below the specified average for thicknesses greater than $\frac{3}{64}$ inch.

[fol. 6475]

Table 1

Nominal Weights of Weather-Resistant Wire and Cable Polyethylene Type
(Pounds per 1000 Feet)

Size	Conductors Weight			Covering		Finished Wire and Cable Weight		
AWG or Mcm	Copper and Copper Alloy	Aluminum	Copper-Covered Steel	Thickness 64ths in.	Weight	Copper and Copper Alloy	Aluminum	Copper-Covered Steel
	Stranded Conductors							
750								
500	1544	469.4	——	5	104	1648	573	——
477	——	447.8	——	5	102	——	550	——
450	1389	422.4	——	5	98	1487	520	——
400	1235	375.5	——	5	99	1334	475	——
397.5	——	373.0	——	5	98.4	——	471	——
350	1081	328.6	——	4	76	1157	405	——
336.4	——	315.7	——	4	74.0	——	390	——
300	926.3	281.6	——	4	69.7	996	351	——
266.8	——	250.4	——	4	64.8	——	315	——
250	771.9	234.7	——	4	62.1	834	297	——
4/0	653.3	198.6	——	4	61.7	715	260	——
3/0	518.1	157.5	——	4	53.9	572	211	——
2/0	410.9	124.9	——	4	47.1	458	172	——
1/0	325.8	99.1	——	4	41.2	367	140	——
1	258.4	78.6	——	3	28.6	287	107	——
2	204.9	62.3	——	3	25.1	230	87.4	——
4	128.9	39.2	——	2	14.1	143	53.3	——
6	81.1	24.6	——	2	10.4	91.5	35.0	——
	Solid Conductors							
1	253.3	——	——	3	19.7	273	——	——
2	200.9	61.1	——	3	18.1	219	79.2	——
3	159.3	——	——	3	16.7	176	——	——
4	126.4	38.4	115.8	2	9.6	136	48.0	125
6	79.5	24.2	72.8	2	7.5	87	31.7	80.3
8	50.0	15.2	45.8	2	6.0	56	21.2	51.8
9	39.6	——	36.3	2	5.4	45	——	41.7
10	31.4	——	28.8	2	5.1	36.5	——	33.9
12	19.8	——	18.1	2	4.2	24	——	22.3

[fol. 6476]

Table 2

Nominal Weights of Weather-Resistant Wire and Cable, Polyethylene Type

ACSR Conductors
(Pounds per 1000 Feet)

Conductors				Covering		Finished Wire and Cable
Size* AWG	Hard-Drawn Copper Equivalent† AWG	Stranding Aluminum/Steel	Weight	Thickness 64ths in.	Weight	Weight
4/0	2/0	6/1	291.1	4	67.9	359
3/0	1/0	6/1	230.8	4	59.2	290
2/0	1	6/1	183.1	4	51.9	235
1/0	2	6/1	145.2	4	45.8	191
1	3	6/1	115.2	3	30.8	146
2	4	7/1	106.7	3	28.3	135
2	4	6/1	91.3	3	27.7	119
3	5	6/1	72.4	3	24.1	96.5
4	6	7/1	67.0	2	15.0	82.0
4	6	6/1	57.4	2	14.6	72.0
5	7	6/1	45.5	2	13.0	58.5
6	8	6/1	36.1	2	11.4	47.5

* Aluminum wires only.

† Area of hard-drawn copper cable [conductivity = 97 percent International Annealed Copper Standard (IACS)] having practically the same d-c resistance as that of the ACSR (aluminum conductivity = 61 percent IACS).

4.3 Weights and Tolerances

4.3.1 The diameters of the conductors of finished wire or the individual strands of stranded conductors in finished cable supplied under these specifications shall meet the requirements and limits of Section 2, Conductors, and the variation in weights from Tables 1 and 2 shall be determined by the dimensional tolerances of Section 2, Conductors.

4.3.2 The average weight of the covering of wire or cable in any lot or shipment of any one size or type manufactured or supplied under these specifications shall be not more than 20 percent over or 10 percent under the nominal weights given in Tables 1 and 2. This average applies to the entire lot or shipment and is not cause for rejection of an individual coil or reel exceeding the allowable variation. Each sample used for this test shall be not less than 2 feet in length for sizes 4/0 AWG and smaller and not less than 1 foot in length for 250,000 circular mils and larger.

4.3.3 The weights of finished wire and cable in Tables 1 and 2 are presented merely as a matter of information for

the convenience of the user of these specifications and are subject to the tolerances resulting from the application of 4.3.1 and 4.3.2.

5. Samples for Test

Samples to determine conformance with Section 4, Acceptance Requirements, shall be taken as prescribed in the following paragraphs:

5.1 Cutting. Fair samples shall be cut from the ends of [fol. 6477] coils or reels, after first cutting back these ends at least 2 feet. These samples shall be cut in half and tagged, one-half to be used for the tests, the other half to be held in reserve for check tests. The samples shall not be distorted or sharply bent.

5.2 Number. The number of samples of each size of wire or cable taken for test shall be as follows:

5.2.1 *Wire or Cable Supplied in Coils*

(1) For coils of standard size exceeding 1000 feet of wire or cable, samples shall be taken from 3 coils of the first lot of 25 coils or fraction thereof, and samples from 1 coil of each additional 25 coils or fraction thereof.

(2) For small coils of less than 1000 feet of wire or cable, samples shall be taken from 3 coils of the first lot of 2500 pounds or fraction thereof, and samples from 1 coil of each additional 2500-pound lot or fraction thereof.

(3) If less than 3 coils are submitted, 1 sample shall be taken from each coil.

5.2.2 *Wire or Cable Supplied on Reels*

(1) For reels of standard size containing 2000 feet or more of wire or cable, samples shall be taken from 3 of the first lot of 30 reels or fraction thereof, and samples from 1 of each additional lot of 10 reels or fraction thereof.

(2) For small reels of less than 2000 feet of wire or cable, samples shall be taken from 3 reels of the first lot 6000 pounds or fraction thereof, and samples from 1 reel of each additional 2000-pound lot or fraction thereof.

(3) If less than 3 reels are submitted, 1 sample shall be taken from each reel.

6. Identification

6.1 The wire shall be so identified that the manufacturer can be determined readily.

7. Packing and Marking

7.1 Packing and marking shall be done in accordance with the purchaser's specification.

8. Inspection

8.1 Inspection and acceptance shall be made at the point of manufacture. The manufacturer shall give the purchaser, or his representative, such access to his works during working hours as is reasonable and necessary to determine the suitability of the material to be supplied and shall furnish the necessary apparatus, labor, and other facilities for making the inspection and acceptance tests herein called for, without cost to the purchaser. Neither inspection, waiving of inspection, nor the purchaser's acceptance shall relieve the manufacturer from obligation to furnish weather-resistant wire in accordance with these specifications.

9. Acceptance or Rejection

9.1 Conformance with these specifications shall be determined as follows:

(1) If 20 percent or more of the samples fail to meet these specifications, an entirely new lot of samples shall be selected at random from the shipment and tested. If the second group of samples fails to meet these specifications as outlined in the preceding sentence, the entire shipment shall be rejected.

(2) The allowable variation in the average weight of the complete covering shown in 4.3 establishes a manufacturing tolerance. Should any shipment of wire or cable exceed this manufacturing tolerance by weight, but be satisfactory in all other respects, the purchaser may accept the shipment but he shall not be required to pay for weather-resistant covering in excess of the allowable variation, and he shall receive credit from the manufacturer for such excess over the maximum permissible

weight of overing at the price charged for the finished wire or cable.

(3) In all cases, even if the shipment of wire or cable is accepted, the coils or reels that fail to meet these specifications shall be rejected, except that individual coils or reels shall not be rejected because covering weights exceed the allowable variation, when the average weight of the entire lot is within the allowable variation, or when the customer elects to accept an entire lot or shipment in which the average weight exceeds the allowable variation.

[fol. 6478]

Appendices

(These Appendices are not a part of American Standard Specifications for Weather-Resistant Wire and Cable, Polyethylene Type, C8.35-1957, but are included to facilitate its use.)

Appendix A

Method of Determining Dispersion of Carbon Black in Polyethylene Compounds

A1. Scope

A1.1 This method describes the apparatus and the procedure for determining the degree of dispersion of carbon black in ethylene plastics. The amount of light transmitted through a film of the material under test is measured under specified conditions. From data so obtained the absorptivity of the sample can be calculated when the thickness of the film is known. This absorptivity can be related empirically to degree of dispersion when carbon black concentration and type are also known.

Note: The method of test for determining the carbon black content in ethylene plastics is contained in Appendix B.

A2. Significance

A2.1 The information provided by this method can be used to determine when optimum dispersion of a carbon black has been achieved in ethylene plastics, or for control purposes, to show that a given minimum level of dispersion has been obtained. The degree of dispersion has been

shown to be related to the resistance of black ethylene plastics to degradation on direct exposure to sunlight.

A3. Apparatus

A3.1 The apparatus shall consist of the following:

(1) An integrating sphere spectrophotometer or photometer which conforms to the apparatus requirements of Standard Method of Test for Haze and Luminous Transmittance of Transparent Plastics, ASTM D 1003-52

(2) A specimen holder suitable for the spectrophotometer to be used.

This may be a sheet of rigid material of dimensions dictated by the device into which it is to be inserted, having at its center an opening which does not restrict the light-beam of the spectrophotometer with which it is to be used. Single- or double-surfaced pressure-sensitive tape may be used to hold the test specimen in place over the opening.

Alternately, a pair of standard thickness (0.05 inch) glass or quartz microscope slides held together at their ends by pressure-sensitive tape may be used. A thin film of glycerine (USP or better grade) shall be used to eliminate air interfaces between the specimen and the slides.

(3) Clean forceps for handling test specimens

(4) A die of dimensions suitable for cutting the test specimen

(5) An analytical balance with a precision of ± 0.0001 gram

(6) A set of Class S weights for use with (5)

(7) A suitable ionizing-type static eliminator to facilitate handling the test specimen

(8) A means for determining the density of the sample to ± 1 per cent

(9) As alternative to (5), (6), and (8), a micrometer capable of measuring the thickness of the film with an accuracy of ± 5 percent or better

A4. Test Specimens

A4.1 The test specimen shall be uniform film of such length and width, or diameter, as required by the apparatus with

which its light transmission is to be measured. The thickness of the film shall be such that its transmittance is no less than 0.003 at the wavelength or wavelengths specified for transmission measurement if a spectrophotometer is to be used.

Note: Suitable films may be prepared by pressing out 2-3 milligrams of sample between polished platens of the design shown in Figs. A1 and A2, using temperatures of 140-185 C and a force of 30 tons.

No special preconditioning of test specimens is required, but care must be taken to prevent their injury or contamination. Specimens shall be handled only with clean, smooth forceps.

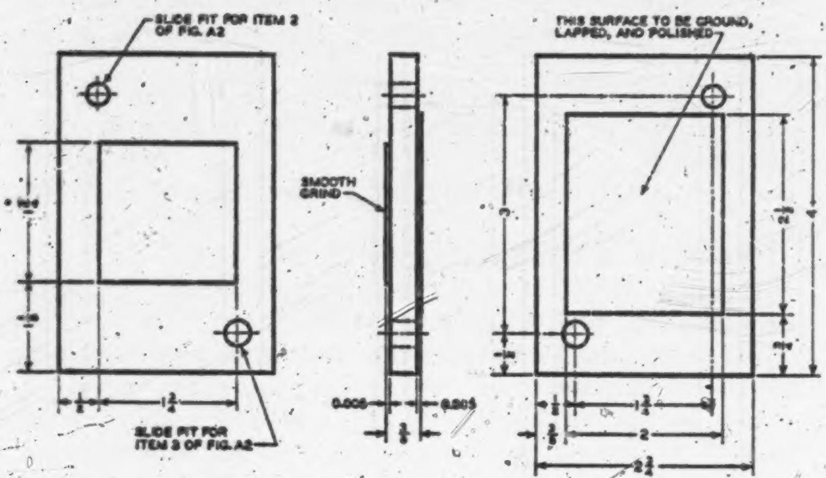
A5. Procedure

A5.1 The average thickness of the test specimen shall be determined from:

(1) Measurement of its weight and density prior to step A5.2, or

(2) Micrometer measurement following step A5.3

[fol. 6479]



Finish: Chromium plate 401A, 0.0002
Material: Kinco Steel, harden to 45 Rockwell "C"
Dimensions expressed in inches.

FIG. A1

A5.2 The specimen shall be mounted in the holder, being handled only with clear forceps. The mounted specimen shall be free of folds or wrinkles.

A5.3 The transmittance of the specimen shall be measured using a procedure approved for the spectrophotometer or integrating sphere photometer being employed and the wavelength or wavelengths called for by the specification covering the material under test. This procedure shall be repeated for three specimens and the results of the three determinations averaged.

Note: Care shall be taken that only the specimen and no portion of the holder or of the pressure-sensitive tape enters the beam of the photometer.

When microscope slides are used to support the test specimen in the holder, a duplicate pair of slides with a film of glycerine between them shall be used as a reference standard.

A5.4 When the thickness of the test specimen is to be measured directly, it shall be determined in accordance with Standard Methods of Test for Thickness of Solid Electrical Insulation, ASTM D 374-42, Method A or C. If glycerine has been used, it shall be removed by careful blotting with clean, lintless, absorbent paper.

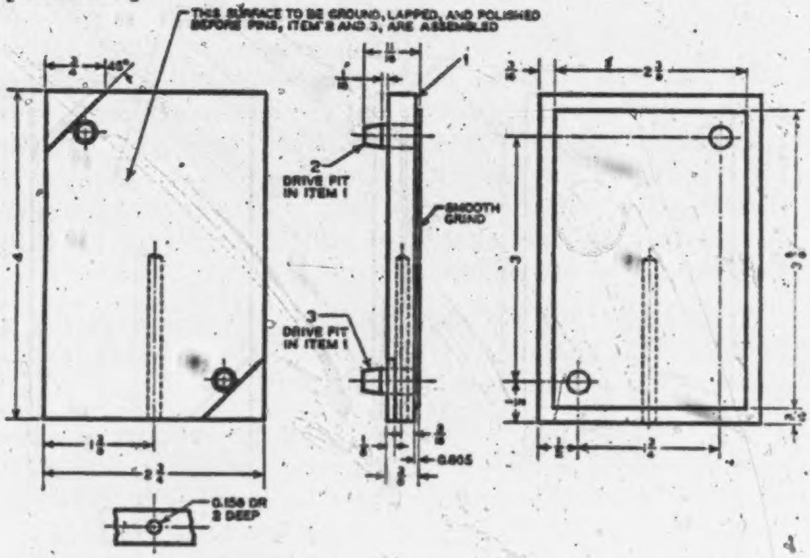
A5.5 The absorptivity of the sample, a, shall be calculated as follows:

$$a = \frac{A}{bc} \tag{Eq A5.5}$$

where

A = absorbency = $\log \frac{1}{T}$
T = transmittance
b = thickness of the specimen (centimeters)
c = concentration of carbon black (grams/cubic centimeter)
$\log = \log_{10}$

[fol. 6480]



Finish for Items 1, 2, and 3: Chromium plate 408A, 0.0002
Material for Item 1: Ketos Steel, harden to 46 Rockwell "C"
Material for Item 2: Drill rod, steel 0.281 dia
Material for Item 3: Drill rod, steel 0.312 dia
Dimensions expressed in inches.

Item	Piece	Name	Req
6			
5			
4			
3		Pin	1
2		Pin	1
1		Plate	1
Stock List			

Fig. A2

[fol. 6481]

A6. Report

A6.1 The report shall include the following:

(1) Absorptivity

(2) Wavelength at which determined

(3) Identification of instrument used

(4) Concentration of carbon black determined according to Appendix B

A7. References

Brode, W. R. *Journal of the Optical Society of America*, 39 (1949), 1024-1031.

Hughes, H. K., et al. *Analytical Chemistry*, 24 (1952), 1349-1354.

Appendix B

Method of Determining Carbon Black Content of Ethylene Plastics

B1. Scope

B1.1 This method describes the apparatus and procedure for determining the carbon black content of ethylene plastics.

B2. Significance

B2.1 The information provided by this method is useful for control purposes and is required for calculation of absorptivity.

B3. Apparatus

B3.1 The apparatus shall consist of the following:

(1) An electric furnace suitable for use with the tubing of (2)

(2) Pyrex or Vicor tubing 1⅛-inch diameter, approximately 4 inches longer than the furnace of (1)

(3) Two rubber or neoprene stoppers to fit tube of (2)

(4) Supplies of 10-millimeter glass tubing and matching rubber or plastic tubing for connections

(5) A combustion boat approximately 3½ inches x ¾ inch x ½ inch. Porcelain or platinum is suitable

(6) A thermometer covering at least the range 300-550 C

(7) A flow meter suitable for measuring gas flow at rates of 1-10 liters per minute.

(8) Three cold traps with removable ground-glass connected heads and 10-mm diameter inner and connecting tubes

(9) A "U"-shaped drying tube, inside diameter 20 mm or larger, fitted with ground glass or neoprene stoppers

(10) A supply of glass wool

(11) A metal desiccator
(12) A Bunsen burner
(13) An analytical balance with a precision of ± 0.0001 gram
(14) A set of Class S weights for use with (13)

B4. Reagents

(1) Purified nitrogen with an oxygen content not greater than 0.01 percent
(2) Pyrogallol, technical grade or better
(3) Potassium hydroxide, technical grade or better
(4) Trichloroethylene, technical grade
(5) Solid carbon dioxide (dry ice)
(6) Anhydrous $CaCl_2$ or other desiccant

B5. Procedure

B5.1 The procedure shall be as follows:

(1) The apparatus shall be set up as shown in Fig. B1. Both cold traps following the combustion tube shall contain trichloroethylene, but only the first need be cooled with dry ice.

(2) A solution of 5 grams pyrogallol and 50 grams potassium hydroxide in 100 milliliters water shall be prepared and enough added to the trap ahead of the drying tube to fill it approximately one-third full.

(3) Anhydrous $CaCl_2$ or other suitable desiccant shall be added to the drying tube and held between loose plugs of glass wool.

(4) A clean combustion boat shall be heated to red heat in a Bunsen flame, then transferred to the metal desiccator and allowed to cool over fresh desiccant for not less than 30 minutes.

(5) The boat shall then be removed from the

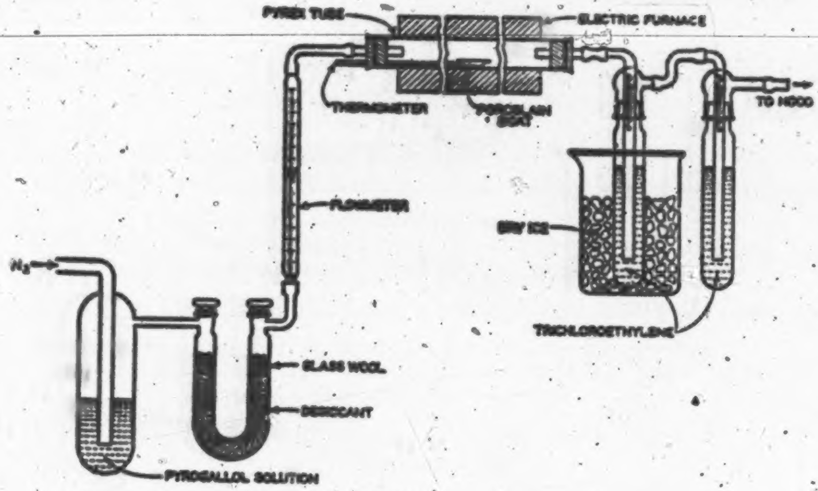


Fig. B1

dessiccator and weighed to nearest 0.0001 gram as quickly as possible.

(6) 1.0 ± 0.1 gram of the ethylene plastic under test shall immediately be placed in the boat and the combination weighed quickly to the nearest 0.0001 gram.

(7) The rate of nitrogen flow shall be adjusted to 1.7 ± 0.3 liters per minute, and the combustion boat with the sample then placed in the Pyrex tube at the center of the furnace with the themometer adjusted so that the bulb is touching the boat. The furnace shall be heated at a rate such that a temperature of 350 C is reached in about 10 minutes, 450 C in another ten minutes, and 500 C after a total of 30 minutes. Heating shall be continued at 500 ± 5 C for an additional 10 minutes.

(8) The tube shall be removed from the furnace with the boat in place and allowed to cool for 5 minutes, the flow of nitrogen being maintained. The boat shall then be removed through the inlet end of the tube and allowed to cool in the desiccator for at least 30 minutes after which the boat and its contents shall be reweighed quickly to the nearest 0.0001 gram.

(9) All determinations shall be made in duplicate. When successive runs are made, the temperature of the

furnace shall be allowed to fall to at least 300 C between determinations.

B6. Calculation

B6.1 The carbon black content shall be calculated as follows:

$$\text{Percent carbon black} = \frac{\text{weight of residue (grams)}}{\text{weight of sample (grams)}} \times 100$$

C = concentration of carbon black (grams/cubic centimeter)

$$= \frac{\text{weight of residue (grams)} \times \text{density of sample}}{\text{weight of sample (grams)}}$$

(Eq B6.1)

B7. Report

B7.1 The report shall include the following:

(1) Identity of the sample
(2) The individual values calculated as in Section 6
(3) The average of the values in B7.1 (2) above

[fol. 6483] IN UNITED STATES DISTRICT COURT

DEFENDANT'S EXHIBIT 27

IPCEA-NEMA Standards Publication

Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

This publication includes and supersedes the following Interim Standards which were previously published for inclusion in IPCEA Pub. No. S-61-402, NEMA Pub. No. WC 5:

#1, November 1960 Shielding of Thermoplastic-insulated Cables
#2, September 1959 Polyethylene Insulation for Wires and Cables
#3, September 1959 Thermoplastic Protective Coverings for Lead-sheathed Cables
#4, November 1959 Thermoplastic-insulated Pole and Bracket Cable
#5, November 1959 Black Polyethylene (Thermoplaslastic) Jacket and Wire Cable
#6, November 1960 Polyvinyl Chloride Insulation, 60 C, for Wires and Cables
#7, November 1960 Polyvinyl - chloride - insulated Cotton-braided Switchboard Wire and Cable

It also supersedes the thermoplastic portion of the IPCEA General Specifications for Wire and Cable with Rubber, Rubber-like and Thermoplastic Insulations, Second Edition, S-19-81.

Approved by Insulated Power Cable Engineers Association January 12, 1961

Approved as a NEMA Standard May 15, 1961

National Electrical Manufacturers Association

[fol. 6484]

Foreword

This Standards Publication for Thermoplastic-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (IPCEA S-61-402; NEMA WC 5-1961) was developed by the Insulated Power Cable Engineers Association and approved by the National Electrical Manufacturers Association.

Suggestions for improvements gained in the use of this standard will be welcomed. They should be sent to the Insulated Power Cable Engineers Association, 283 Valley Road, Montclair, N. J.

Table of Contents—Condensed

For a detailed Table of Contents, see page ii.
For a detailed listing of the appendices, see page v.
For a detailed listing of the tables contained in this publication, see page vi.

[fol. 6485]

Part 1

General

1.1 Scope. These standards apply to materials, constructions and testing of thermoplastic-insulated wires and cables which are used for the transmission and distribution of electrical energy for normal conditions of installation and service, either indoors, aerial, underground or submarine.

The thermoplastic insulations and jackets covered in this publication are compounds made from polyvinyl chloride, or the copolymer of vinyl chloride and vinyl acetate, or polyethylene.

In classifying jackets and sheaths in these standards, the term "jacket" refers to nonmetallic coverings and "sheath" to continuous metallic coverings.

1.2 General Information. These standards cover the requirements for conductors, the various grades of insulations and protective coverings, and general constructional and dimensional details common to most standard types of wires and cables. Constructions of specific types are covered in Part 7. Where a conflict exists between the requirements of Part 7 and those of Parts 1 to 6, inclusive, the requirements of Part 7 shall apply.

1.3 Information to be Supplied by Purchaser.* When requesting proposals from cable manufacturers, the prospective purchaser should furnish the following information:

1.3.1 Characteristics of System on which Cable is to be Used.

(a) Current—alternating or direct.
(b) Frequency—cycles per second.
(c) Normal operating voltage phases or, if direct current, between conductors.
(d) Number of phases and conductors. If series lighting, give open-circuit voltage and state whether system is operated with or without protectors.
(e) Operated with neutral solidly grounded, grounded

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* This paragraph has been approved by NEMA as Authorized Engineering Information.

through resistance or reactance, or ungrounded. If grounded through resistance or reactance state amount.

(*f*) Minimum temperature at which cable will be installed.

(*g*) Description of installation.

(*1*) In buildings.

(*2*) In underground ducts.

(*3*) Aerial.

a. On messenger in metal rings.

b. On messenger with marlin ties.

c. Preassembled.

d. Field spun.

(*4*) Direct burial in ground.

(*5*) Submarine.

(*6*) Descriptions other than the foregoing.

(*h*) Conditions of installations.

(*1*) Ambient temperature.

(*2*) Number of loaded cables in duct bank or conduit. If in conduit, give type of conduit (metallic or nonmetallic), number of loaded conduits, enclosed or exposed, and spacing between conduits.

(*3*) Load factor.

(*4*) Method of bonding and grounding of lead sheaths.

(*5*) Wet or dry location.

1.3.2 Quantities and Description of Cable

(*a*) Total number of feet, including test lengths, and lengths if specific lengths are required.

(*b*) Type of cable. Describe as single conductor, 2-conductor flat, 2-conductor round, etc.

(*c*) Rated circuit voltage, phase to phase.

(*d*) Type of conductor—copper or aluminum.

(*e*) Size of conductors—Awg or circular mils. If conditions require other than standard stranding, a complete description should be given.

(*f*) Type and grade of insulation.

(*g*) Thickness of insulation in 64ths of an inch or in mils.

(*h*) Type of outer covering.

(i) Maximum allowable overall diameter in inches. When duct space is not limited, it is desirable not to restrict the overall diameter.

(j) Method of conductor identification.

[fol. 6486]

Part 2

Conductors

2.1 Material. Conductors shall be annealed uncoated copper, or annealed coated copper, or aluminum.

2.1.1 Copper Conductors. Uncoated conductors shall be of annealed copper wire in accordance with ASTM B 3.

Coated conductors shall be of annealed copper wire in accordance with ASTM B 33 for tin-coated conductors or ASTM B 189 for lead- or lead-alloy-coated conductors.

The continuity of tin coating shall be determined in accordance with ASTM B 33 before the conductors are insulated or stranded.

The continuity of lead and lead-alloy coatings shall be determined in accordance with ASTM B 189 before the conductors are insulated or stranded.

2.1.2 Aluminum Conductors. Solid conductors 8 Awg and smaller shall be "EC" grade aluminum three-quarter hard in accordance with ASTM B 262. Solid conductors larger than 8 Awg and all sizes of stranded conductors shall be "EC" grade aluminum either hard-drawn in accordance with ASTM B 230 or three-quarter hard in accordance with ASTM B 262. Stranded conductors shall conform to ASTM B 231.

2.2 Solid Conductors. Conductors 8 Awg and smaller shall be solid or, when required for a particular application, stranded. Conductors 6 Awg and larger may be solid as indicated in Table 1 when required. Nominal diameters shall be in accordance with Table 1, subject to the tolerances given in 2.5.

2.3 Stranded Conductors

2.3.1 Conductors 6 Awg and larger shall be stranded in accordance with 2.3.3. For series lighting cable conductors 6 and 4 Awg may be solid.

Stranded conductors shall be composed of the number of wires given in Tables 1 through 6 and subject to the tolerances on cross-sectional areas given in 2.5. Intermediate sizes take the stranding of the next larger conductor size given in the tables.

2.3.2 Strand shielding shall be used on stranded conductors of power cables having rated circuit voltages above 2000 volts. This requirement does not apply to series lighting cables.

Strand shielding in thermoplastic-insulated cables is a conducting material at least 0.0025 inch thick applied over the surface of the conductor. It may be conducting nonmetallic tape, conducting compound, or conducting cement.

2.3.3 Uses of Classes of Stranding

2.3.3.1 *Concentric-lay Conductors.* A concentric-lay conductor is a conductor composed of a central core surrounded by one or more layers of helically laid wires.

Class of Stranding *	Use
B	Power cables rated 0–2000 volts for normal use and, where strand shielding is employed (see 2.3.2.), for use above 2000 volts.
C	Power cables where more flexible stranding than Class B is desired.
D	Power cables where extra flexible stranding is desired.

* See Table 1.

See Appendix E for complete titles and dates of ASTM standards to which reference is made in this publication.

[fol. 6487] 2.3.3.2 *Rope-lay Conductors.* A rope-lay conductor is a conductor composed of concentric-lay stranded members or bunch-stranded members.

Classes G and H shall have concentric-lay-stranded members, and Classes I, K and M shall have bunch-stranded members.

Class of Stranding	Use
G (see Table 2)	All cables for portable use.
H (see Table 3)	All cables where extreme flexibility is required, such as for use on take-up sheaves, etc.
I (see Table 4)	Apparatus cable and motor-leads.
K (see Table 5)	Cords and cables composed of No. 30 Awg copper wires.
M (see Table 6)	Cords and cables composed of No. 34 Awg copper wires.

Other strandings are given in Part 7.

2.3.4 The individual wires used in the construction of the stranded conductor shall, before stranding, meet the requirements of 2.1.

2.3.5 The lay of concentric stranded conductors shall be in accordance with ASTM B 8 for copper conductors and ASTM B 231 for aluminum conductors (see Appendix E). The lay of a layer of wires shall be not less than eight nor more than sixteen times the outside diameter of that layer, except that for conductors composed of 37 wires or more, this requirement shall apply only to the two outer layers.

The direction of lay of the outer layer shall be left-hand.

The direction of lay for conductors having a nominal cross-sectional area larger than 8 Awg shall be reversed in successive layers.

2.4 Individual Wire Splices in Solid and Stranded Conductors. A splice in a solid conductor in one of the individual wires of a stranded conductor shall be made in a workmanlike manner and shall be such that the joint will not increase the diameter of the individual wire or of the conductor nor lessen its mechanical strength. A joint or splice in a stranded conductor as a whole shall be made by separately joining each individual wire in such a manner that the overall diameter of the entire stranded conductor will not be increased. In rope-stranded conductors, the primary groups used in forming the rope shall be considered the equivalent of a solid wire in a concentric stranded conductor.

2.5 Tolerances in Diameters and Cross-sectional Areas. The following tolerances apply to determinations made on conductors of the completed cable.

	Diameter, Inches	Maximum Variation in Diameter
Solid copper conductors		
Coated	0.010 and larger	−1%, +3%
	Smaller than 0.010	−0.1 mil, +0.3 mil
Uncoated	0.010 and larger	−1%, +1%
	Smaller than 0.010	−0.1 mi., +0.1 mil
Solid aluminum conductors	0.100 and larger	−1%, +1%
	0.036 up to 0.100	−1 mil, +1 mil
	Smaller than 0.036	−0.5 mil, +0.5 mil

[fol. 6488] 2.5.2 Cross-sectional Areas

2.5.2.1 In stranded conductors, the area of cross-section of the completed conductor shall be not less than 98 percent of the area given in Table 1 and not less than 97 percent of the area given in Table 1 for 18 and 20 Awg conductors made with 30 Awg strands when measured in accordance with 6.3.4.

2.5.2.2 In rope-lay-stranded conductors having bunch-stranded members (Classes I, K and M), the number of individual wires may vary from that given in Tables 4, 5 or 6, provided the cross-sectional area of the conductor is in accordance with 2.5.2.1.

2.5.2.3 The cross-sectional area of a stranded conductor shall be the sum of its component wires at any point, when measured in accordance with 6.3.4.

2.6 Resistance of Conductors

2.6.1 The direct-current resistance of solid or Class B stranded coated conductors at 20 C or 25 C shall not exceed the values given in Table 7.

The direct-current resistance of solid or Class B stranded uncoated conductors at 20 C or 25 C shall not exceed by more than 2 percent the values given in Table 7.

2.6.2 For flexible stranded conductors and for sizes not listed in Table 7, the direct-current resistance at 20 C or 25 C shall be not greater than that calculated from the factors given in Table 8.

2.6.3 In completed multiple-conductor cables the increase in resistance due to conductor cabling lay shall not exceed the values given in Tables 7 and 8 by more than the following percentages:

(*a*) One layer of conductors 2
(*b*) More than one layer of conductors 3
(*c*) Pairs or other pre-cabled units 4

2.6.4 When the direct-current resistance is measured at other than 20 C or 25 C, it shall be corrected by using the multiplying factors given in Tables 9 and 10.

Factors for temperatures other than those given in the tables shall be obtained by interpolation or shall be calculated from the formulae given in the footnotes to Tables 9 and 10.

2.5.1 Diameters

[fol. 6489]

Part 7

Construction of Specific Types

The requirements of Parts 1 through 6 shall be met except as otherwise modified in Part 7.

7.1 Pole and Bracket Table

7.1.1 *Scope.* This section applies to flat-twin pole and bracket cable insulated with polyvinyl chloride and belted with polyethylene. This cable is intended for use in series street lighting circuits in both interior and exterior installations for operation at temperatures not exceeding 75 C. The conductor sizes covered are 10, 8 and 6 Awg. The insulation and belt thicknesses are based on a maximum of 600 volts between conductors and on open-circuit voltages from 4000 to 10000 volts.

7.1.2 *Conductors*

7.1.2.1 The conductors shall be of annealed uncoated copper or annealed coated copper and shall meet the requirements of 2.1.1 and 2.3.

7.1.2.2 The sizes, minimum number of strands, average cross-sectional areas and approximate diameters of the conductors shall be as follows:

Size Awg	Minimum Number of Strands/Conductor	Average Cross-sectional Area, Circular Mils	Approximate Diameter, Inches
10	19	10,380	0.117
8	19	16,510	0.148
6	19	26,240	0.186

The area of cross-section of any conductor shall be not less than 98 percent of the area given in the above table.

7.1.3 *Insulation*

7.1.3.1 The polyvinyl chloride insulation shall meet the requirements given in 3.7, except that both the tensile strength and elongation after 168 hours at 100 ± 1 C shall be not less than 85 percent of the unaged values, and the cold bend test shall be conducted at minus 30, plus or minus 1 C.

7.1.3.2 The average thickness of the insulation shall be not less than that given in Table 45. The minimum thickness shall be not less than 90 percent of the values given in the table. The thickness shall be measured in accordance with 6.4.3.

7.1.3.3 One conductor shall be colored black and the other white or natural.

7.1.4 *Conductor Assembly.* The two insulated conductors shall be laid flat and parallel.

7.1.5 *Belt*

7.1.5.1 The belt shall be a heat- and light-stabilized black polyethylene insulation and shall meet the physical and aging requirements for polyethylene insulation as given in 3.9.1. It shall be applied in a flat configuration. Fillers shall not be used. The belt insulation shall fill the interstices of the cable.

7.1.5.2 The average thickness of the belt shall be not less than that given in Table 45.

7.1.6 *Electrical Tests*

7.1.6.1 The completed cable shall withstand the following voltage tests after being immersed in water for at least 6 hours.

7.1.6.2 An alternating-current test voltage of 3000 volts shall be applied between conductors for 5 minutes.

7.1.6.3 The conductors shall be connected together, and the alternating-current and direct-current test voltages given in Table 45 shall be applied between the conductor and water.

7.1.7 *Cold Bend Test.* The polyethylene belt shall not show any cracks when conditioned and tested in accordance with 6.4.15.1. The cable shall be bent around its minor axis. The insulated conductor diameter given in 6.4.15.1 shall be taken as the minor axis of the cable. Cracking of the polyvinyl chloride insulation on the individual conductors under this test shall not constitute failure.

7.1.8 *Outside Diameters.* The outside diameters of the completed cable shall be not less than that given in Table 45, with a tolerance of plus 10 percent.

[fol. 6490] Table 45

Construction and Test Requirements for Pole and Bracket Cable

Open-circuit Voltage, Volts	Conductor Size, Awg	Thickness, Mils Insulation	Thickness, Mils Belt	Minimun Outside Diameter, Inches Major	Minimun Outside Diameter, Inches Minor	Test Voltages, Kv A-C 5 Min	Test Voltages, Kv D-C 15 Min
4001–6000	10	47	94	0.610	0.400	13.0	39.0
	8	47	94	0.670	0.430	13.0	39.0
	6	62	94	0.810	0.500	13.0	39.0
6001–10000	10	47	109	0.640	0.430	17.0	51.0
	8	47	109	0.700	0.460	17.0	51.0
	6	62	109	0.840	0.530	17.0	51.0

7.1.9 *Bending Radius**. The minimum radius to which these cables may be bent around their minor axis in service is 2 inches, with a maximum of ½ turn (180-degree U bend).

7.1.10 *Terminations**. Suitable high-temperature terminations are recommended where the cable will be exposed to temperatures, in close proximity to the luminaire, in excess of 75 C.

[fol. 6491] 7.2 Polyvinyl-chloride-insulated Cotton-braided Switchboard Wire and Cable

7.2.1 *Scope.* This section covers single-conductor switchboard wire and cable insulated with polyvinyl chloride and covered with a cotton braid, in sizes 14 through 4/0 Awg with copper conductors and 12 Awg through 350 MCM with aluminum conductors. The wire or cable is suitable for operation at conductor temperatures of 90 C (194 F) and less, in dry locations, at a maximum voltage rating of 600 volts.

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* These paragraphs have been approved by NEMA as Authorized Engineering Information.

It is similar to but may differ from Underwriters' Laboratories, Inc., Type TBS.

7.2.2 *Conductors*

7.2.2.1 *Copper.* Copper conductors shall be annealed coated or uncoated copper and shall meet the requirements of 2.1.1 and 2.3. Sizes 14 though 4 Awg shall be either solid or Class B stranded in accordance with Table 1. Sizes 3 Awg through 4/0 Awg shall be Class B stranded.

7.2.2.2 *Aluminum.* Aluminum conductors shall be "EC" grade and shall meet the requirements of 2.1.2 and 2.3. Sizes 12 through 4 Awg shall be either solid or Class B stranded in accordance with Table 1. Sizes 3 Awg through 350 MCM shall be Class B stranded.

7.2.3 *Separator.* A separator, when used, shall consist of a helical or longitudinal wrapping of paper or other suitable material.

7.2.4 *Insulation*

7.2.4.1 The insulation shall consist of an extruded polyvinyl chloride (or its copolymer with vinyl acetate) compound. When tested in accordance with Part 6, the insulation shall meet the following requirements:

Physical Requirements	
Tensile strength, minimum, psi	1500
Elongation at rupture, minimum, percent	100
Aging Requirements—after air oven test at 121 ± 1 C for 168 hours	
Tensile strength, minimum, percentage of unaged value	70
Elongation at rupture, minimum, percentage of unaged value	65

7.2.4.2 *Insulation Thickness.* The average thickness of the insulation shall be not less than that given in Table 46. The minimum thickness shall be not less than 90 percent of the values given in the table.

Table 46

Insulation Thickness

Conductor Size, Awg or MCM *	Insulation Thickness, Mils
14-10	31
8	47
6-2	62
1-4/0	78
225-350†	94

* MCM—thousands of circular mils.
† Aluminum conductors only.

7.2.5 *Covering and Finish*

7.2.5.1 *Braid.* A closely woven soft cotton braid meeting the requirements for Class B braids given in 4.5 of the *IPCEA-NEMA Standards Publication for Rubber-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy,* IPCEA S-19-81 (Third Edition), NEMA WC 3-1959, shall be applied over the insulation.

7.2.5.2 *Finish.* The braid shall be impregnated with a flame-retarding compound.

7.2.6 *Tests.*. The completed wire shall meet the following requirements.

7.2.6.1 *Dripping Test* After the following dripping test, the saturating compound shall not have dripped.

A 7-inch specimen of the wire or cable shall be suspended vertically in an electrically heated oven which is equipped with a suitable automatic temperature control and which has been heated to 97 ± 1 C (204.8 to 208.4 F). The specimen shall be maintained at this temperature for one hour. A piece of white paper shall be placed beneath the specimen to catch any of the compound which drips.

7.2.6.2 *Flame-retarding Requirement.* A 22-inch specimen of the wire shall meet the vertical flame test described in 6.5.

7.2.6.3 *Voltage Test.* The insulation on a 12-inch specimen of the wire shall withstand for one minute the alternating-current voltage indicated in the following table. The central 6-inch portion of the 12-inch specimen shall be wrapped in metal foil, and the voltage shall be applied between the conductor and the metal foil.

Conductor Size, Awg or MCM *	A-C Test Voltage, Volts
14–10	1500
8–2	2000
1–4/0	2500
225–350†	3000

* MCM=thousands of circular mils.
† Aluminum conductors only.

[fol. 6492] 7.3 Neutral-supported Secondary and Service Drop Cables

7.3.1 *Scope.* This section covers secondary and service drop cables composed of one or more polyethylene-insulated conductors and one neutral conductor for use as the supporting member. These cables are for use on circuits not exceeding 300 volts to ground.

7.3.2 *Conductors*

7.3.2.1 *Insulated Conductors*

7.3.2.1.1 Copper. Copper conductors shall be annealed uncoated copper and shall meet the requirements given in Part 2. Size 8 Awg shall be solid. Sizes 6 Awg and larger shall be Class B stranded in accordance with Table 1.

7.3.2.1.2 Aluminum. Aluminum conductors shall be "EC" grade, with a minimum tensile strength of 17,000 psi. Size 6 Awg shall be solid. Size 4 Awg and larger shall be Class B stranded in accordance with Table 1, except that the outer layer shall have a right-hand lay.

7.3.2.2 *Neutral Conductors.* Neutral conductors shall be uncovered or covered and the sizes and composition shall be in accordance with Table 47.

7.3.2.2.1 Copper. Copper conductors shall be hard-drawn bare copper and shall be Class B stranded in accordance with Table 1, except that sizes 6 Awg and smaller may be solid.

7.3.2.2.2 Aluminum. Aluminum conductors shall be "EC" grade, hard-drawn aluminum, stranded in accordance with

Class A, Table II, ASTM B 231*, except sizes 3/0 and 4/0 shall be 19-wire stranded.

7.3.2.2.3 Copper and Copper-covered-steel Composite. Conductors shall be concentric-lay stranded copper and copper-covered-steel composite conductors and shall meet the requirements given in the applicable sections of ASTM B 229.*

7.3.2.2.4 Aluminum Conductors—Steel Reinforced. Aluminum conductors steel reinforced, (ACSR), shall be 7-wire strand (6 aluminum around 1 steel) and shall meet the requirements of ASTM B 232.*

7.3.3 *Insulation*

7.3.3.1 *Physical and Aging Requirements.* The polyethylene insulation shall be black and, when tested in accordance with Part 6, shall meet the following requirements:

Physical Requirements	
Tensile strength, minimum, psi	1400
Elongation at rupture, minimum, percent	350
Aging Requirements—after air oven test at 100 ± 1 C for 48 hours	
Tensile strength, minimum, percentage of unaged value	75
Elongation at rupture, minimum, percentage of unaged value	75

7.3.3.2 *Thickness of Insulation.* The average thickness of the insulation shall be not less than the following:

Conductor Size, Awg	Thickness, Inches
8–2	0.045
1–4/0	0.060

The minimum thickness shall be not less than 90 percent of the foregoing values.

7.3.4 *Assembly.* One or more insulated conductors shall be twisted around the neutral conductor without fillers with a lay of 25 to 60 times the diameter of one of the insulated conductors. The direction of lay of the insulated conductors shall be the same as that of the outer layer of wires of the neutral conductor.

The size of the neutral conductor shall be in accordance with Table 47.

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* See Appendix E.

7.3.5 ***Tests.*** **Each length of completed cable shall successfully withstand, after one hour's immersion in water, an alternating-current voltage of 1500 volts applied for one minute between each insulated power conductor and ground.**

[fol. 6493]

Table 47

Power and Neutral Conductors

Insulated Power Sizes, Awg		Neutral Conductor Sizes, Awg			
		For Use with Copper or Aluminum Insulated Power Conductors		For Use with Aluminum Insulated Power Conductors Only	
Copper	Aluminum	Copper	Copper Covered Steel *	All Aluminum	(ACSR)
8	6	8	8 C	6	6
6	4	6	6 C	4	4
6	4	8	8 C	...	6
4	2	4	4 A	2	2
4	2	6	6 C	...	4
2	1/1	2	2 F	1/0	1/0
2	1/1	4	4 A	...	2
1	2/0	1	1 F	2/0	2/0
1	2/0	3	3 A	...	1
1/0	3/0	1/0	1/0 F	3/0	3/0
1/0	3/0	2	2 F	...	1/0
2/0	4/0	2/0	2/0 F	4/0	4/0
2/0	4/0	1	1 F	...	2/0

* See ASTM B 229 (see Appendix E) for letter designations and construction.

[fol. 6494] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 28

March 1959.

IPCEA-NEMA Standards Publication

Rubber-insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

This publication supersedes the following:

IPCEA General Specifications for Wire and Cable with Rubber, Rubber-like and Thermoplastic Insulations, Second Edition, S-19-81

NEMA Standards for Rubber-insulated Power and Control Cable, 49-141

Approved by Insulated Power Cable Engineers Association July 15. 1958

Approved as a NEMA Standard November 13, 1958, National Electrical Manufacturers Association

[fol. 6495] **Foreword**

This Standards Publication for Rubber-insulated Wires and Cables for the Transmission and Distribution of Electrical Energy (IPCEA S-19-81 Third Edition; NEMA WC 3-1959) was developed by the Insulated Power Cable Engineers Association and approved by the National Electrical Manufacturers Association.

Suggestions for improvements gained in the use of this standard will be welcomed. They should be sent to the Insulated Power Cable Engineers Association, 283 Valley Road, Montclair, N. J.

Table of Contents—Condensed

For a detailed Table of Contents, see page ii.
For a detailed listing of the appendices, see page ix.
For a detailed listing of the tables contained in this publication, see page x.

[fol. 6496]

Part 1

General

1.1 Scope. These standards apply to materials, constructions and testing of rubber-insulated wires and cables which are used for the transmission and distribution of electrical energy for normal conditions of installation and service, either indoors, aerial, underground or submarine.

In classifying vulcanized insulations and jackets in these standards, the term "rubber" when used alone without further description shall mean either natural rubber or synthetic rubber, or a combination of these materials.

In classifying jackets and sheaths in these standards, the term "jacket" refers to nonmetallic coverings and "sheath" to continuous metallic coverings.

1.2 General Information. These standards cover the requirements for conductors, the various grades of insulations and protective coverings, and general constructional and dimensional details common to most standard types of wires and cables. Constructions of specific types are covered in Part 7. Where a conflict exists between the requirements of Part 7 and those of Parts 1 to 6, inclusive, the requirements of Part 7 shall apply.

1.3 Information to be Supplied by Purchaser.* When requesting proposals from cable manufacturers, the prospective purchaser should furnish the following information:

1.3.1 Characteristics of System on which Cable is to be Used

(*a*) Current—alternating or direct.
(*b*) Frequency—cycles per second.
(*c*) Normal operating voltage between phases or, if direct current, between conductors.
(*d*) Number of phases and conductors. If series lighting, give open-circuit voltage and state whether system is operated with or without protectors.
(*e*) Operated with neutral solidly grounded, grounded through resistance or reactance, or ungrounded.

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* For the purposes of NEMA, this paragraph is approved as Authorized Engineering Information.

If grounded through resistance or reactance, state amount.

(*f*) Minimum temperature at which cable will be installed.

(*g*) Description of installation.

(*1*) In buildings.
(*2*) In underground ducts.
(*3*) Aerial.

a. On messenger in metal rings.
b. On messenger with marlin ties.
c. Preassembled.
d. Field spun.

(*4*) Direct burial in ground.
(*5*) Submarine.
(*6*) Descriptions other than the foregoing.

(*h*) Conditions of installations.

(*1*) Ambient temperature.
(*2*) Number of loaded cables in duct bank or conduit. If in conduit, give type of conduit (metallic or nonmetallic), number of loaded conduits, enclosed or exposed, and spacing between conduits.
(*3*) Load factor.
(*4*) Method of bonding and grounding of lead sheaths.
(*5*) Wet or dry location.

1.3.2 *Quantities and Description of Cable*

(*a*) Total number of feet, including test lengths, and lengths if specific lengths are required.

(*b*) Type of cable. Describe as single conductor, 2-conductor flat, 2-conductor round, etc.

(*c*) Rated circuit voltage, phase to phase.

(*d*) Type of conductor—copper or aluminum.

(*e*) Size of conductors—Awg or circular mils. If conditions require other than standard stranding, a complete description should be given.

(*f*) Grade of insulation.

(g) Thickness of insulation in 64ths of an inch or in mils.
(h) Type of outer covering.
(i) Maximum allowable overall diameter in inches. When duct space is not limited, it is desirable not to restrict the overall diameter.
(f) Method of conductor identification.

[fol. 6497]

Part 2

Conductors

2.1 Material. Part 2 covers copper conductors and aluminum conductors.

2.1.1 *Copper Conductors.* Uncoated conductors shall be of annealed copper wire in accordance with ASTM B 3, latest revision.

Coated conductors shall be of annealed copper wire in accordance with the latest revision of ASTM B 33 for tin-coated conductors or ASTM B 189 for lead- or lead-alloy-coated conductors.

The conductors, unless otherwise specified herein, shall be protected by tin, lead, or lead-alloy coating.

The continuity of tin coating shall be determined in accordance with ASTM B 33, latest revision, before the conductors are insulated or stranded.

The continuity of lead and lead-alloy coatings shall be determined in accordance with ASTM B 189, latest revision, before the conductors are insulated or stranded.

2.1.2 *Aluminum Conductors.* Solid conductors 8 Awg and smaller shall be "EC" grade aluminum three-quarter hard in accordance with ASTM B 262, latest revision. Solid conductors larger than 8 Awg and all sizes of stranded conductors shall be "EC" grade aluminum either hard-drawn in accordance with ASTM B 230 or three-quarter hard in accordance with ASTM B 262, latest revisions. Stranded conductors shall conform to ASTM B 231, latest revision.

2.2 Solid Conductors. Conductors 8 Awg and smaller shall be solid or, when required for a particular application, stranded. Conductors 6 Awg and larger may be solid as indicated in Table 1 when required. Nominal diameters

shall be in accordance with Table 1, subject to the tolerances given in 2.5.

2.3 Stranded Conductors.

2.3.1 Conductors 6 Awg and larger shall be stranded in accordance with 2.3.3. For series lighting cable and tree wire, conductors 6 and 4 Awg may be solid.

Stranded conductors shall be composed of the number of wires given in Tables 1 through 6 and subject to the tolerances on cross-sectional areas given in 2.5. Intermediate sizes take the stranding of the next larger conductor size given in the tables.

2.3.2 Strand shielding shall be used on stranded conductors of power cables having rated circuit voltages above 2000 volts. This requirement does not apply to series lighting cables.

Strand shielding in rubber-insulated cables is a conducting material at least 0.0025 inch thick applied over the surface of the conductor and vulcanized or firmly bonded to the inner surface of the insulation. It may be conducting nonmetallic tape, conducting compound, or conducting cement.

2.3.3 *Uses of Classes of Stranding*

2.3.3.1 *Concentric-lay Conductors.* A concentric-lay conductor is a conductor composed of a central core surrounded by one or more layers of helically laid wires.

Class of Stranding *	Use
B	Power cables rated 0–2000 volts for normal use and, where strand shielding is employed (see 2.3.2), for use above 2000 volts.
C	Power cables where more flexible stranding than Class B is desired.
D	Power cables where extra flexible stranding is desired.

* See Table 1.

[fol. 6498] 2.3.3.2 *Rope-lay Conductors.* A rope-lay conductor is a conductor composed of concentric-lay stranded members or bunch-stranded members.

Classes G and H shall have concentric-lay-stranded members, and Classes I, K and M shall have bunch-stranded members.

Class of Stranding	Use
G (see Table 2)	All cables for portable use.
H (see Table 3)	All cables where extreme flexibility is required, such as for use on take-up sheaves, etc.
I (see Table 4)	Apparatus cable and motor-leads.
K (see Table 5)	Cords and cables composed of No. 30 Awg copper wires.
M (see Table 6)	Cords and cables composed of No. 34 Awg copper wires.

Other strandings are given in Part 7.

2.3.4 The individual wires used in the construction of the stranded conductor shall, before stranding, meet the requirements of 2.1.

2.3.5 The lay of concentric stranded conductors shall be in accordance with the latest revision of ASTM B 8 for copper conductors and ASTM B 231 for aluminum conductors. The lay of a layer of wires shall be not less than eight nor more than sixteen times the outside diameter of that layer, except that for conductors composed of 37 wires or more, this requirement shall apply only to the two outer layers.

The direction of lay of the outer layer shall be left-hand. The direction of lay for conductors having a nominal cross-sectional area larger than 8 Awg shall be reversed in successive layers.

2.4 Individual Wire Splices in Solid and Stranded Conductors. A splice in a solid conductor or in one of the individual wires of a stranded conductor shall be made in a workman-like manner and shall be such that the joint will not increase the diameter of the individual wire or of the conductor nor lessen its mechanical strength. A joint or splice in a stranded conductor as a whole shall be made by separately joining each individual wire in such a manner that the overall diameter of the entire stranded conductor will not be increased. In rope-stranded conductors, the primary groups used in forming the rope shall be considered the equivalent of a solid wire in a concentric stranded conductor.

2.5 Tolerances in Diameters and Cross-sectional Areas. The following tolerances apply to determinations made on conductors of the completed cable.

2.5.1 *Diameters*

	Diameter, Inches	Maximum Variation in Diameter
Solid copper conductors		
Coated	0.010 and larger	−1%, +3%
	Smaller than 0.010	−0.1 mil, +0.3 mil
Uncoated	0.010 and larger	−1%, +1%
	Smaller than 0.010	−0.1 mil, +0.1 mil
Solid aluminum conductors	0.100 and larger	−1%, +1%
	0.036 up to 0.100	−1 mil, +1 mil
	Smaller than 0.036	−0.5 mil, +0.5 mil

[fol. 6499] 2.5.2 *Cross-sectional Areas*

2.5.2.1 In stranded conductors, the area of cross-section of the completed conductor shall be not less than 98 per cent of the area given in Table 1 for 18 and 20 Awg conductors made with 30 Awg strands when measured in accordance with 6.3.4.

2.5.2.2 In rope-lay-stranded conductors having bunch-stranded members (Classes I, K and M), the number of individual wires may vary from that given in Tables 4, 5 or 6, provided the cross-sectional area of the conductor is in accordance with 2.5.2.1.

2.5.2.3 The cross-sectional area of a stranded conductor shall be the sum of its component wires at any point, when measured in accordance with 6.3.4.

2.6 Resistance of Conductors

2.6.1 The direct-current resistance of solid or Class B stranded conductors at 20 C or 25 C shall not exceed the values given in Table 7.

2.6.2 For flexible stranded conductors and for sizes not listed in Table 7, the direct-current resistance at 20 C or 25 C shall be not greater than that calculated from the factors given in Table 8.

2.6.3. In completed multiple-conductor cables the increase in resistance due to conductor cabling lay shall not exceed the values give- in Tables 7 and 8 by more than the following percentages:

(*a*) Non-portable cables:

(*1*) One layer of conductors 2

(*2*) More than one layer of conductors 3

(*3*) Pairs or other pre-cabled units 4

(*b*) Portable cords and cables 5

2.6.4 When the direct-current resistance is measured at other than 20 C or 25 C, it shall be corrected by using the multiplying factors given in Tables 9 and 10.

Factors for temperatures other than those given in the tables shall be obtained by interpolation or shall be calculated from the formulae given in the footnotes to Tables 9 and 10.

[fol. 6500]

Part 7

Constructions of Specific Types

The requirements of Parts 1 through 6 shall be met except as otherwise modified in Part 7

7.1 Pole and Bracket Cable

7.1.1 *Scope.* This section covers the following types of rubber-insulated two-conductor pole and bracket cables for use in series lighting circuits:

Type A—Belted cable having a belt of insulation and a fibrous covering over the insulated conductors.

Type B—Flat twin cable having only a fibrous covering over the insulated conductors.

Conductor sizes are 10, 8 and 6 Awg, and insulation thicknesses are based on a maximum of 600 volts between conductors and from 600 to 10000 volts between conductors and ground.

Recommended bending radii are given in Appendix F.

7.1.2 *Conductors*

7.1.2.1 The conductors shall be of coated copper and shall meet the requirements of 2.1.1 and 2.3.

7.1.2.2 The sizes, minimum number of strands, average cross-sectional areas and approximate diameters of the conductors shall be as follows:

Size, Awg.	Minimum Number of Strands/Conductor	Average Cross-sectional Area, Circular Mils	Approximate Diameter, Inches
10	19	10,380	0.117
8	19	16,510	0.148
6	19	26,240	0.186

The area of cross-section of any conductor shall be not less than 98 per cent of the area given in the above table.

7.1.3 *Insulation.* The insulation shall be one of the grades given in Table 11.

The average thickness of the insulation shall be not less than that given in Table 57. The minimum thickness shall be not less than 90 per cent of the values given in the table.

7.1.4 *Tape or Braid Over the Individual Conductor*

7.1.4.1 A tape or braid shall be applied over the insulation of each conductor.

7.1.4.2 Tape, where used, shall meet the requirements of 4.4.

7.1.4.3 Braid, where used, shall meet the requirements for Class B braids given in 4.5. Where circuit identification (see 7.1.5) is obtained by means of colors, the braids shall be suitably treated. Where circuit identification is obtained by means of one conductor having a pronounced large size thread tracer, the braids shall be saturated with a weather-resisting compound.

7.1.5 *Circuit Identification.* Circuit identification shall be obtained either by means of colored braids or tapes which shall be one black and one white, or by having a pronounced large size thread tracer on one conductor.

7.1.6 *Belted Cables*

7.1.6.1 In belted cable, the two insulated and taped or braided wires shall lay flat and parallel and a belt of insulation which meets the requirements of 7.1.3 shall be applied in either a round or oval shape. Fibrous fillers shall not be used. The belt insulation shall thoroughly fill the interstices of the cable.

7.1.6.2 The average thickness of the belt shall be not less

than that given in Table 57. The minimum thickness shall be not less than 90 per cent of the values given in the table.

7.1.6.3 A tape and braid or a double braid shall be applied over the belt insulation.

7.1.6.4 A tape, where used over the belt insulation, shall be compound-filled in accordance with 4.4.

[fol. 6501] 7.1.6.5 Both inner and outer braids, where used over the belt insulation, shall meet the requirements for Class B braids given in 4.5 and shall be saturated with a moisture-resisting compound.

7.1.7 *Flat Twin Cable.* A Class B braid which meets the requirements of 4.5 shall be applied over the parallel insulated and taped or braided conductors. The braid shall be saturated and finished with a moisture-resisting compound.

7.1.8 *Voltage Test*

7.1.8.1 The completed cable shall withstand the following voltage tests after being immersed in water for at least 6 hours.

7.1.8.2 On belted cables, an alternating-current test voltage of 3000 volts shall be applied between conductors for 5 minutes.

7.1.8.3 On belted and flat twin cables, the conductors shall be connected together, and the alternating-current test voltage given in Table 57 shall be applied between the conductor and water for 5 minutes.

7.1.9 *Outside Diameters.* Nominal outside diameters of the completed cables shall be in accordance with Table 57 with a tolerance of plus or minus 5 per cent.

Table 57

Pole and Bracket Cable

Open-circuit Voltage, Volts	Conductor Size, Awg	Thickness of Insulation and Belt, 64ths of an Inch: Individual Conductor	Belt	Total	Nominal Outside Diameter	A-C Test Voltage, Kv: Cables with Ozone-resisting Insulation	Cables with other than Ozone-resisting Insulation
0-600	10	3	0	3	0.53	4.5	3.0
	8	4	0	4	0.65	6.0	3.5
	6	4	0	4	0.73	6.0	3.5
601-1000	10	4	0	4	0.59	6.0	5.0
	8	4	0	4	0.65	6.0	5.0
	6	5	0	5	0.79	7.5	6.0
1001-2000	10	5	0	5	0.65	7.5	6.0
	8	5	0	5	0.72	7.5	6.0
	6	6	0	6	0.87	8.5	7.5
2001-3000	10	6	0	6	0.72	8.5	7.5
	8	6	0	6	0.78	8.5	7.5
	6	7	0	7	0.93	10.0	9.0
3001-4000	10	7	0	7	0.78	10.0	9.0
	10	3	4	7	0.70	10.0	9.0
	8	7	0	7	0.84	10.0	9.0
	8	3	4	7	0.76	10.0	9.0
	6	8	0	8	0.99	11.5	10.0
	6	4	4	8	0.92	11.5	10.0
4001-6000	10	9	0	9	0.91	13.0	11.0
	10	3	6	9	0.76	13.0	11.0
	8	9	0	9	0.98	13.0	11.0
	8	3	6	9	0.82	13.0	11.0
	6	4	5	9	0.95	13.0	11.0
6001-7000	10	3	7	10	0.79	14.0	12.5
	8	3	7	10	0.86	14.0	12.5
	6	4	6	10	0.98	14.0	12.5
7001-9000	10	3	8	11	0.82	15.5	13.5
	8	3	8	11	0.90	15.5	13.5
	6	4	7	11	1.01	15.5	13.5
9001-10000	10	3	9	12	0.86	17.0	15.0
	8	3	9	12	0.93	17.0	15.0
	6	4	8	12	1.04	17.0	15.0

[fol. 6502] 7.2 Nonmetallic Neoprene-jacketed Mine Power Cables

7.2.1 *Scope.* This section covers heat-, moisture- and ozone-resisting rubber-insulated shielded, three-conductor, neoprene-jacketed cables with grounding conductors in sizes 6 to 4/0 Awg for nominal alternating-current voltage service of 5 and 10 kv. They are available with two grades of insulation for operation at maximum conductor temperatures of either 75 C or 85 C.

The approximate phase-to-phase 60-cycle voltage drop per ampere per 1000 feet at various circuit power factors and ampacities are given in Appendix C. Recommended bending radii are given in Appendix F.

7.2.2 *Power and Grounding Conductors*

7.2.2.1 Power conductors, except for bore-hole and shaft cables, shall be of annealed coated copper wire and shall meet the requirements given in Part 2.

7.2.2.2 Power conductors for borehole and shaft cables shall be of annealed coated copper wire or, when the factor of safety as calculated by the following formula is less than 7, of medium hard-drawn coated copper in accordance with ASTM B 246 before stranding.

$$F = \frac{AT}{W}$$

where

F—Factor of safety.
A—Area of the three power conductors in square inches.
T—Tensile strength of copper in pounds per square inch (24000 for annealed copper and 40000 for medium hard copper).
W—Weight of the cable in pounds.

The conductor stranding shall be Class B or Class C in accordance with Part 2 and Table 58.

7.2.2.3 Grounding conductors shall be of annealed coated copper wire, shall meet the requirements of Part 2, and shall be Class B stranded. One grounding conductor shall be placed in each interstice of the cable in contact with

metallic shielding. The size of each grounding conductor shall be in accordance with Table 58. The aggregate total cross-sectional area of the three grounding conductors shall be not less than 90 per cent of the area of one power conductor. The minimum size of an individual grounding conductor shall be 10 Awg.

7.2.3 *Strand Shielding.* Strand shielding (see 2.3.2) shall be applied over the power conductors.

7.2.4 *Insulation.* The insulation shall be in accordance with Part 3.

The insulation for 75 C operation shall meet the requirements of 3.14 or 3.15.

The insulation for 85 C operation shall meet the requirements of 3.15.

The average thickness of insulation shall be not less than that given in Table 58 for grounded and ungrounded neutral circuits. The minimum thickness shall be not less than 90 per cent of the values given in the table.

Note: A circuit is considered to have a grounded neutral if it is metallically continuous to a point where the neutral is permanently connected to earth and if facilities are provided to insure prompt isolation of a faulty element of a system of which the circuit is a part.*

7.2.5 *Conductor or Circuit Identification.* Conductors shall be identified by a tape in accordance with 5.6.1.

7.2.6 *Metallic Shielding.* Metallic shielding, in accordance with Part 4, shall be applied over the individual conductors.

7.2.7 *Jacket.* A neoprene jacket which meets the requirements of 4.13.3 and Table 29 shall be applied.

[fol. 6503] 7.2.8 *Overall Diameters.* The nominal overall diameters of the cables shall be in accordance with Table 58, within plus 8 per cent and minus 5 per cent.

7.2.9 *Tests.* The cables shall be tested in accordance with Part 6 and shall meet the requirements given in Part 3 and 7.2.

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* For the purposes of NEMA, this note is approved as Authorized Engineering Information.

The corona levels shall be as follows:

Voltage Classification, Kv	Minimum Corona Level, Kv Grounded Neutral	Minimum Corona Level, Kv Ungrounded Neutral
5	3.2	5.0*
10	6.4	8.9

* Unless otherwise indicated, the cable will be rated grounded neutral.

Table 58

Mine Power Cable Nonmetallic Neoprene-jacketed

Size Awg	Power Conductor Number of Strands Class B	Power Conductor Number of Strands Class C	Grounding Conductor Size in Each Interstice, Awg	Power Conductor Insulation Thickness, Inches Grounded Neutral	Power Conductor Insulation Thickness, Inches Ungrounded Neutral	Overall Diameters, Inches Grounded Neutral	Overall Diameters, Inches Ungrounded Neutral
			5000-volt Cables				
6	7	19	10	0.156	0.156	1.43	1.43
4	7	19	9	"	"	1.54	1.54
2	7	19	7	"	"	1.68	1.68
1	19	37	6	"	"	1.79	1.79
1/0	19	37	5	"	"	1.88	1.88
2/0	19	37	4	"	"	1.99	1.99
3/0	19	37	3	"	"	2.10	2.10
4/0	19	37	2	"	"	2.23	2.23
			10000-volt Cables				
6	7	19	10	0.219	0.281	1.75	2.04
4	7	19	9	"	"	1.86	2.14
2	7	19	7	"	"	2.00	2.30
1	19	37	6	"	"	2.08	2.39
1/0	19	37	5	"	"	2.14	2.49
2/0	19	37	4	"	"	2.30	2.59
3/0	19	37	3	"	"	2.42	2.70
4/0	19	37	2	"	"	2.54	2.83

[fol. 6504] 7.3 Preassembled Aerial Cable Using Copper Conductors.

7.3.1 *Scope.* This section covers preassembled aerial cables with one or more copper conductors in Sizes 6 Awg to 500 MCM which are individally insulated with a rubber compound and covered and which are attached to a messenger to form self-supporting aerial cables for use on power transmission and distribution systems operating at 15 kv or less phase to phase.

The characteristics of the completed assembly shall be such that the cable can be installed at a minimum temperature of minus 10 C (14 F).

Ampacities and recommended bending radii are given in Appendices E and F, respectively.

7.3.2 *Conductors.* All insulated power conductors shall be of annealed coated copper in accordance with Part 2. The conductors shall be Class B or Class C stranded in accordance with Part 2 except that, when required, size 6 Awg may be solid. For ratings above 2000 volts, each stranded conductor shall be covered with strand shielding in accordance with 2.3.2.

7.3.3 *Insulation.* The insulation shall be applied in accordance with the applicable sections of Part 3. The average thickness of the insulation shall be not less than that given in Table 12. The minimum thickness shall be not less than 90 per cent of the values given in the table.

For cables rated 2000 volts or less, the insulation shall be one of the grades given in Table 11. For cables rated above 2000 volts, the insulation shall be in accordance with 3.14 or 3.15.

7.3.4 *Coverings.* The covering over the insulation of each conductor shall be in accordance with one of the following:

Type	Description	Maximum Operating Voltage, Phase to Phase, Kv — Grounded Neutral	Ungrounded Neutral
I	Nonshielded, jacketed	5	5
II	Shielded, nonjacketed	15	15
III	Shielded, jacketed	15	15

7.3.4.1 *Type I.* A jacket of nonconducting neoprene compound which meets the requirements of 4.13.4 and Table 27 shall be applied over the insulation of each conductor.

7.3.4.2 *Type II.* A fibrous or other nonmetallic tape shall be applied over the insulation of each conductor. The tape shall be either conducting or nonconducting and, if conducting, shall be so marked. An additional fibrous tape may be applied over the first tape. Over the tape or tapes, a helically wrapped nonmagnetic stainless steel, nonmagnetic monel or bronze shielding tape have a thickness of at least 0.0045 inch shall be applied with a lap of not less than 15 per cent of its width.

7.3.4.3 *Type III.* A fibrous or other nonmetallic tape shall be applied over the insulation of each conductor. The

tape shall be either conducting or nonconducting and, if conducting, shall be so marked. An additional fibrous tape may be applied over the first tape. Over the tape or tapes, a helically wrapped metallic shielding tape which meets the requirements of 4.1 shall be applied. A fibrous tape which meets the requirements of 4.4 may be applied over the shielding. A jacket of nonconducting neoprene compound which meets the requirements of 4.13.4 and Table 28 shall be applied over the shielding tape or, if used, over the fibrous tape.

7.3.5 *Conductor or Circuit Identification.* Each conductor of multiple-conductor cable shall be permanently marked so that conductor identification may be made without exposing the insulation. Identification shall be made by means of colored jackets, ribs on the outer surface of jackets, or by embossing letters or numerals on the outer covering.

Single-conductor cable shall not be identified.

Jacketed cables shall be identified to indicate the manufacturer.

7.3.6 *Assembly.* The conductors shall be cabled together with a suitable lay. The messenger shall be laid parallel to the axis of a single conductor or the cabled conductors. The cabled conductors shall be bound to the messenger by means of a soft-copper binding strip. The binding strip shall have a pitch of from 3 to 6 inches, shall be rectangular with rounded edges, and shall have the following nominal dimensions:

[fol. 6505]

Diameter of Cable Assembly, Excluding Messenger, Inches	Binding Strip Thickness, Inches	Binding Strip Width, Inches
0–1.000	0.025	0.250
1.001 and over	0.030	0.375

The messenger shall extend 5 feet beyond each end of the conductors for use in installing the cable.

7.3.7 *Messenger Sizes.* The messenger shall be either composite stranded copper and copper-covered steel in accordance with ASTM B 229, or Grade 30 EHS stranded copper-covered steel in accordance with ASTM B 228.

The messenger sizes shall be as follows. These sizes are expressed as designations for single-conductor cables and as messenger diameters in inches for multiple-conductor cables.

Conductor Size, Awg or MCM*	Messenger Sizes — Cable Voltage Rating — Up to 5 Kv, Inclusive	6 to 15 Kv, Inclusive
	Single Conductor	
6†	6D	6D
4†	4D	4D
2†	2J	2J
	Two and Three Conductor	
6†	5/16	5/16
4†	5/16	5/16
2†	5/16	3/8
1	5/16	3/8
1/0	5/16	3/8
2/0	3/8	1/2
3/0	3/8	1/2
4/0	1/2	1/2
350	1/2	1/2
500	1/2	1/2

* MCM—thousands of circular mils.
† See limits on conductor size in Table 12.

7.3.8 *Design Criteria.** The messenger size shall be based on a normal stringing tension at 60 F not exceeding 30 per cent of the ultimate strength and a maximum tension not exceeding 50 per cent of ultimate strength at fully loaded condition. The tabulation of messenger sizes given in 7.3.7 apply to grounded neutral cables up to 4/0 Awg on the basis of a 150-foot ruling span, 30 inches maximum sag under normal conditions, and after heavy loading conditions of ½ inch ice and 8 pound wind at 0 F. One-half inch messenger is the largest size messenger listed in the table and, for cable sizes over 500 MCM, greater sags or shorter spans should be used. For single-phase circuits, the resistance of the messenger should be not greater than that of the conductor.

7.3.9 *Tests.* The cable shall be tested in accordance with Part 6 and shall meet the requirements of Part 3 and 7.3.

* For the purposes of NEMA, this paragraph is approved as Authorized Engineering Information.

The final test voltage shall be 80 per cent of the test voltage specified in Table 12. Cables with Type I covering shall be immersed in water during the final test.

[fol. 6506] 7.4 Neutral-supported Secondary and Service Drop Cables

7.4.1 *Scope.* This section covers secondary and service drop cables composed of one or more neoprene-insulated conductors and one neutral conductor for use as the supporting member. These cables are for use on circuits not exceeding 300 volts to ground.

7.4.2 *Conductors*

7.4.2.1 *Insulated Conductors*

7.4.2.1.1 Copper. Copper conductors shall be annealed uncoated copper and shall meet the requirements given in Part 2. Size 8 Awg shall be solid. Sizes 6 Awg and larger shall be Class B stranded in accordance with Table 1.

7.4.2.1.2 Aluminum. Aluminum conductors shall be "EC" grade, with a minimum tensile strength of 17,000 psi. Size 6 Awg shall be solid. Size 4 Awg and larger shall be Class B stranded in accordance with Table 1, except that the outer layer shall have a right-hand lay.

7.4.2.2 *Neutral Conductors.* Neutral conductors shall be uncovered or covered and the sizes and composition shall be in accordance with Table 59.

7.4.2.2.1 Copper. Copper conductors shall be hard-drawn bare copper and shall be Class B stranded in accordance with Table 1, except that sizes 6 Awg and smaller may be solid.

7.4.2.2.2 Aluminum. Aluminum conductors shall be "EC" grade, hard-drawn aluminum, stranded in accordance with Class A, Table II, ASTM B 231, except sizes 3/0 and 4/0 shall be 19-wire stranded.

7.4.2.2.3 Copper and Copper-covered-steel Composite. Conductors shall be concentric-lay stranded copper and copper-covered steel composite conductors and shall meet the requirements given in the applicable sections of ASTM B 229.

7.4.2.2.4 Aluminum Conductors—Steel Reinforced. Aluminum conductors steel reinforced, (ACSR), shall be 7-wire strand (6 aluminum around 1 steel) and shall meet the requirements of ASTM B 232.

7.4.3 *Insulation*

7.4.3.1 *Physical and Aging Requirements.* The neoprene insulation shall be black and, when tested in accordance with Part 6, shall meet the following requirements:

Physical Requirements	
Tensile strength, minimum, psi	1200
Elongation at rupture, minimum, per cent	250
Set in 2-inch gauge length, maximum, inches	⅜
Aging Requirements	
After air oven test at 70 ± 1 C for 168 hours:	
Tensile strength, minimum, percentage of unaged value	75
Elongation at rupture, minimum, percentage of unaged value	65
After oxygen pressure test at 70 ± 1 C for 96 hours:	
Tensile strength, minimum, percentage of unaged value	75
Elongation at rupture, minimum, percentage of unaged value	65
After oil immersion test at 121 ± 1 C for 18 hours:	
Tensile strength, minimum, percentage of unaged value	60
Elongation at rupture, minimum, percentage of unaged value	60

7.4.3.2 *Thickness of Insulation.* The average thickness of the insulation shall be not less than the following:

Conductor Size, Awg	Thickness, Inches
8–2	0.062
1–4/0	0.078

The minimum thickness shall be not less than 90 percent of the foregoing values.

7.4.4 *Assembly.* One or more insulated conductors shall be twisted around the neutral conductor without fillers with a lay of 25 to 60 times the diameter of one of the insulated conductors. The direction of lay of the insulated conductors shall be the same as that of the outer layer of wires of the neutral conductor.

The size of the neutral conductor shall be in accordance with Table 59.

[fol. 6507] 7.4.5 *Tests.* Each length of completed cable shall successfully withstand, after one hour's immersion in water, an alternating-current voltage of 1500 volts applied for one minute between each insulated power conductor and ground.

Table 59

Power and Neutral Conductors

Insulated Power Conductor Sizes, Awg		Neutral Conductor Sizes, Awg			
		For Use With Copper or Aluminum Insulated Power Conductors		For Use With Aluminum Insulated Power Conductors Only	
Copper	Aluminum	Copper	Copper Covered Steel*	All Aluminum	(ACSR)
8	6	8	8 C	6	6
6	4	6	6 C	4	4
6	4	8	8 C	...	6
4	2	4	4 A	2	2
4	2	6	6 C	...	4
2	1/0	2	2 F	1/0	1/0
2	1/0	4	4 A	...	2
1	2/0	1	1 F	2/0	2/0
1	2/0	3	3 A	...	1
1/0	3/0	1/0	1/0 F	3/0	3/0
1/0	3/0	2	2 F	...	1/0
2/0	4/0	2/0	2/0 F	4/0	4/0
2/0	4/0	1	1 F	...	2/0

* See ASTM B 229 for letter designations and construction.

[fol. 6508] IN UNITED STATES DISTRICT COURT

DEFENDANT'S EXHIBIT 29a

Lost Business Since April, 1957 (Taken from Potential Business Reports)

Competitor	Pounds Aluminum
Anaconda	16,854,833
Central Cable	921,461
Essex	1,010,150
General Cable	2,758,974
General Electric	175,643
Kaiser	25,844,457
Midland	178,602
Nehring	3,718,218
Paranite	3,248,803
Reynolds	27,749,319
Rome Cable	22,455
Southern Electric	3,449,748
Southwire	6,352,903
Texas Wire	17,700
Unknown	18,371,631
Total	110,674,897

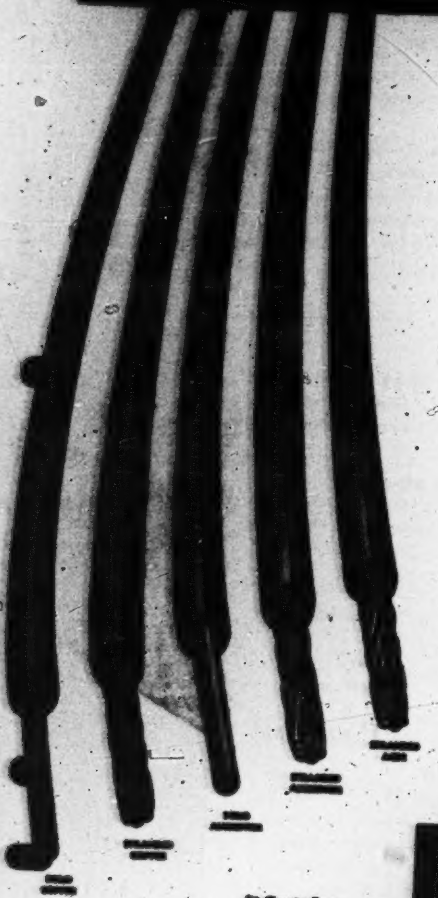
DEFENDANTS' EXHIBIT 30

3345

Bulletin WP-2A
Superseding WP-1A

File
Index
2

Rome RoPrene



NEOPRENE COVERED WEATHERPROOF WIRE

Copper, Aluminum and Aluminum-Steel Reinforced (ACSR) Conductors

Resists Moisture, Sunlight, Weathering, Corrosive Atmospheres, Abrasion

Lighter Weight and Smaller Diameter

Smoother, Easier to Pull Over Crossarms

Nonrotting and Nonfestooning

Easier to Strip Clean

Rome RoPrene (Neoprene) Covered Weatherproof Wire provides extra service life because it is inherently tough. It has exceptional weathering stability, is unaffected by industrial fumes and is easier to handle.

RoPrene weatherproof compound provides an homogeneous, seamless covering and is completely vulcanized; i.e., thermosetting. In addition to its many desirable physical characteristics, RoPrene has insulating properties which are much superior to the more conventional fibrous coverings. RoPrene Weatherproof Wire may be used, and is recommended, for the same applications as identical sizes of braided and knitted types of weatherproof. Methods of handling and installation are the same as for the braided and knitted types.

Further, with RoPrene covering reduced wall thicknesses are possible. The result is a smaller and lighter wire. RoPrene Weatherproof is smoother, easier to pull over crossarms. Its smaller diameter and rubber-like surface make it easy to handle.

RoPrene Weatherproof Wire is manufactured in accordance with ASA specifications for weather-resistant wire, Neoprene type.

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME, NEW YORK

ROME CABLE ROME, N.Y.

[fol. 6510]

RoPrene Weatherproof Wire

SCOPE:

This specification covers Neoprene weather-resistant wire, manufactured in accordance with the requirements of the American Standards specifications for Weather-resistant Wire and Cable, Neoprene Type.

CONDUCTORS:

Before covering, the copper, aluminum or ACSR conductors shall be in accordance with the latest issue of ASA and ASTM specifications as applicable. Tolerances for tensile strength and elongation after covering shall be in accordance with the ASA specification for Weather-resistant Wire, Neoprene Type.

COVERING:

The conductor shall be covered with a tight-fitting seamless RoPrene (Neoprene) compound complying with ASA specifications to the average wall thicknesses shown in the table.

PHYSICAL PROPERTIES OF ROPRENE

Tensile strength, min. psi	1400
Elongation at rupture, min. percent	250
Set in 2-inch gauge length, max. in.	3/8
Tensile strength after 96 hrs. in oxygen bomb @ 70C and 300 psi, min. psi	75% of original
Elongation at rupture after 96 hrs. in oxygen bomb at 70C and 300 psi, min. percent	65% of original
Tensile strength after 18 hrs. in oil @ 121C, min. psi	60% of original
Elongation at rupture after 18 hrs. in oil @ 121C, min. percent	60% of original

The minimum wall thickness at any one point shall not be more than 5 mils below the specified average for thickness 3/64 inch and under, and not more than 10 percent below the specified average for 4/64 inch and over.

WEIGHTS AND TOLERANCES:

The average weight of the covering in any lot of any one size or type manufactured under this specification shall vary not more than plus or minus 15 percent of the nominal weights as listed in the tables. The finished wire weights listed in the tables are nominal weights only and are subject to conductor and covering weight tolerances.

[fol. 6511]

	Size AWG or CM	Number of Wires	Covering Average Thickness Inch	Nominal Overall Diameter Inch	Nominal Weight Pounds per 1000 Ft.			Standard Packing*	
					Bare Conductor	Nominal Covering	Finished Weatherproof	Coils Feet	Reels Feet
COPPER CONDUCTOR	12	Solid	2/64	.144	19.8	7.7	27.5	2850	
	10	Solid	2/64	.165	31.4	9.2	40.6	3470	
	8	Solid	3/64	.223	50.0	18.0	68.0	2700	5000
	6	Solid	3/64	.256	79.5	21.5	101.0	1800	4000
	4	Solid	3/64	.298	126.4	25.6	152.0	1200	2500
	2	Solid	3/64	.352	200.9	31.1	232.0	1000	1000
	6	7	3/64	.278	81.1	26.9	108.0	1800	4000
	4	7	3/64	.326	128.9	34.1	163.0	1200	2500
	2	7	3/64	.386	204.9	43.1	248.0	1000	1000
	1	7	4/64	.453	258.4	64.6	323.0		1000
	1/0	7	4/64	.493	325.8	72.2	398.0		4000
	2/0	7	4/64	.539	410.9	83.1	494.0		3500
	3/0	7	4/64	.589	518.1	93.9	612.0		3000
	4/0	7	4/64	.647	653.3	107.7	761.0		2500
ALL-ALUMINUM CONDUCTOR	8	Solid	3/64	.223	15.2	18.0	33.2	4000	
	6	Solid	3/64	.256	24.2	21.5	45.7	3100	
	4	Solid	3/64	.298	38.4	25.6	64.0	2900	
	2	Solid	3/64	.352	61.1	31.1	92.2	1800	
	6	7	3/64	.278	24.6	26.9	51.5	2800	
	4	7	3/64	.326	39.2	34.1	73.3	2000	
	2	7	3/64	.386	62.3	43.1	105.0	1500	
	1	7	4/64	.453	78.6	64.6	143.0	1000	8500
	1/0	7	4/64	.493	99.1	72.2	171.0	1000	7000
	2/0	7	4/64	.539	124.9	83.1	208.0		5500
	3/0	7	4/64	.589	157.5	93.9	251.0		4400
	4/0	7	4/64	.647	198.6	107.7	306.0		3500
	266,800	19	5/64	.750	250.4	137.5	388.0		5000
	336,400	19	5/64	.823	315.7	156.0	472.0		4000
	397,500	19	6/64	.912	373.0	202.4	575.0		3000
ALUMINUM CONDUCTOR STEEL REINFORCED (ACSR)	6	6AL/1St.	3/64	.292	36.1	28.9	65.0	2500	5800
	5	6AL/1St.	3/64	.317	45.5	33.0	78.5	2000	6800
	4	6AL/1St.	3/64	.344	57.4	37.1	94.5	1800	5400
	4	7AL/1St.	3/64	.351	67.0	38.0	105.0	1800	7100
	3	6AL/1St.	3/64	.375	72.4	41.6	114.0	1400	4300
	2	6AL/1St.	3/64	.410	91.3	47.7	139.0	1100	6800
	2	7AL/1St.	3/64	.419	106.7	48.3	155.0	1100	4500
	1	6AL/1St.	4/64	.480	115.2	69.8	185.0	900	5400
	1/0	6AL/1St.	4/64	.523	145.2	78.8	224.0	800	3200
	2/0	6AL/1St.	4/64	.572	183.1	89.9	273.0		5100
	3/0	6AL/1St.	4/64	.627	230.8	103.2	334.0		2700
	4/0	6AL/1St.	4/64	.688	291.1	117.9	409.0		2100

*See next page for Special Wholesalers Package

[fol. 6512]

3348

SPECIAL WHOLESALERS PACKAGE

Rome RoPrene soft drawn and medium hard drawn copper Weatherproof Wire is packaged in 500-foot cartons for convenient storage and handling. This special package applies to copper Weatherproof Wire only in the sizes tabulated at right and the wire is sold on a linear basis (per 1000 ft.) rather than on a weight basis.

Size AWG	Nominal Shipping Weight Per 1000 Feet
14	19.0
12	27.5
10	40.6
8	68.0
6	101.0
4*	152.0

*500 ft. paper wrapped coils, not in a carton

OTHER ROME CABLE PRODUCTS

- Power Cable
- Control Cable
- Street Lighting Cable
- Self-supporting Aerial Cable
- Mining Cable
- Signal Cable
- Diesel Locomotive Cable
- Special Electronic Cables
- Portable Cords
- Hook-up Wire
- Machine Tool Wire
- Magnet Wire
- Building Wire
- Bare and Weatherproof Wire

SALES OFFICES

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Chamber of Commerce Bldg.
80 Federal St.

CHICAGO 39, ILL.
4505 West Grand Ave.

CLEVELAND 14, OHIO
Society for Savings Bldg.
145 Public Square

DALLAS 26, TEXAS
3015 Taylor St.

DENVER 4, COLO.
1160 Elati St.

DETROIT 2, MICH.
547 New Center Bldg.

HOUSTON 2, TEXAS
866 Merchants & Mfrs. Bldg.

KANSAS CITY 11, MO.
406 West 34th St.

LOS ANGELES 22, CALIF.
2510 South Malt Ave.

NEW YORK 17, N. Y.
60 East 42nd St.

PHILADELPHIA 7, PA.
12 South Twelfth St.

PITTSBURGH 22, PA.
1901 Oliver Bldg.

PORTLAND 5, ORE.
1020 S. W. Taylor St.

ST. LOUIS 8, MO.
4378 Lindell Blvd.

ST. PAUL 4, MINN.
345 N. Wheeler Ave.

SALT LAKE CITY 1, UTAH
230 South Fourth West St.

SAN FRANCISCO 24, CALIF.
1100 Selby St.

SEATTLE 4, WASH.
3430 Fourth Ave., South

Warehouse Stocks maintained at Atlanta, Chicago, Dallas, Denver, Los Angeles, Rome, St. Paul, Salt Lake City, San Francisco, Seattle

[fol. 6513] In United States District Court

Defendants' Exhibit 31

Bulletin RCP-[illegible]
(File Index [illegible])
[illegible]

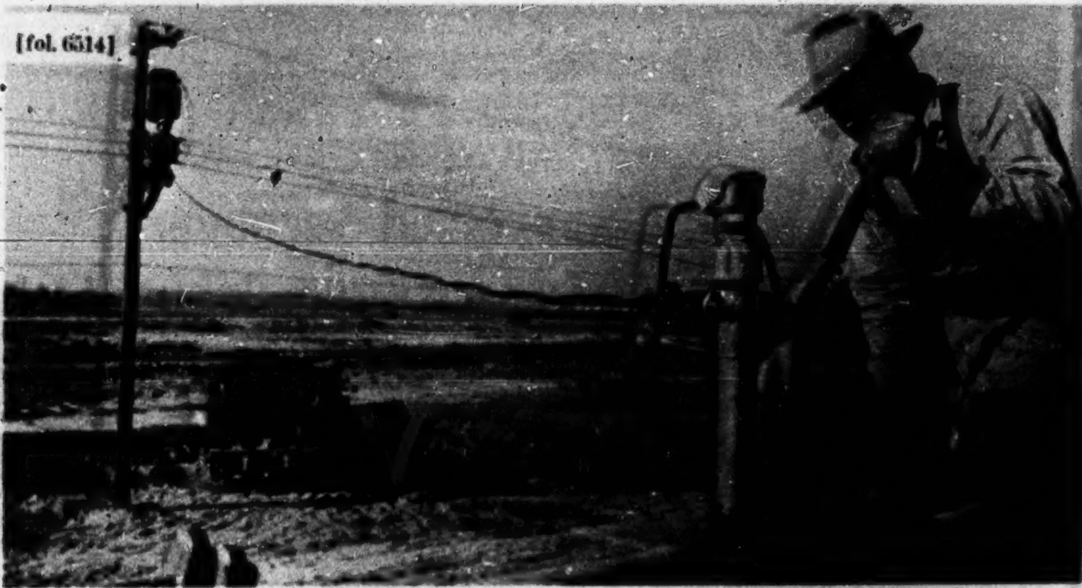
Roprene and Rolene Insulated

Neutral-Supported Secondary and Service Drop Cables

with copper or aluminum power conductors

ROME CABLE
CORPORATION

[fol. 6514]

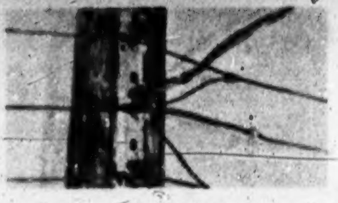


This original Rome Cable development of time-proven construction, Roprene or Rolene Service Drop and Secondary Cable consists of Roprene (Neoprene) or Rolene (polyethylene) insulated power conductors spiralled around a "straight-away" neutral conductor for mechanical support. It offers simplicity in construction, economy of installation, longer life under all weather conditions . . . plus the neater appearance of a single cable favorably compared to open wires.

You get these advantages when you install Rome's Triplex

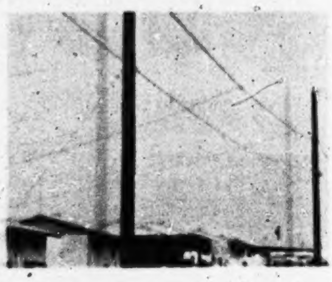
1. Rapid, simple installation because of compactness and less handling
2. Clean, neat appearance (no unsightly multiple wires)
3. High resistance to ice-loading, high wind and other severe winter conditions
4. Maximum protection against sunlight, heat, moisture, corrosive atmospheres and abrasion
5. Mid-span tapping of secondaries permits longer spans and fewer poles
6. Better voltage regulation on secondaries (lower reactance in long and heavily loaded circuits)
7. Eliminates the necessity of using crossarms
8. Less hardware
9. Provides a safer pole for future maintenance work by allowing free climbing and more working area

Over ten years ago, Rome Cable pioneered the development of this interesting and economical cable, which may be used for service drops, overhead multiple street lighting circuits, or for overhead secondary cable. Years of trouble-free service have proved the economy and utility of this cable construction.



Less Hardware needed for service tap connections at the pole.

Simplified dead-head connection at the house or industrial establishment



Mid-span taps permit longer spans with fewer poles

SPECIFICATIONS

for Neutral-supported Secondary and Service Drop Cables

SCOPE

This specification applies to secondary and service drop cable consisting of one or more power conductors covered with insulating Roprene (polychloroprene) or Rolene (polyethylene) and twisted around a neutral messenger. This product which is most generally a duplex (2 conductors), triplex (3 conductors), or quadrex (4 conductors) type, is intended for service drops and overhead secondary applications. This specification is based upon IPCEA standards.

CONDUCTORS

A. Power

1. Copper power conductors shall be soft annealed bare copper conforming to ASTM specification B 3. Size No. 8 AWG shall be solid. Sizes No. 6 AWG and larger shall be Class B stranded in accordance with ASTM specification B 8.
2. Aluminum power conductors shall be "EC" grade with a minimum tensile strength of 17,000. psi. Size No. 6 AWG shall be solid. Sizes No. 4 AWG and larger shall be Class B stranded in accordance with ASTM specification B 231.

B. *Neutral Messenger

1. Copper conductors shall be hard-drawn bare copper stranded in accordance with Class B, ASTM specification B 8, except No. 6 AWG and smaller may be solid.
2. Aluminum conductors shall be "EC" grade, hard-drawn aluminum stranded in accordance with Class A, ASTM specification B 231, except sizes No. 3/0 and 4/0 shall be 19-wire stranded.
3. Copperweld conductors shall be stranded copper and copper covered steel composite conductors in accordance with the applicable sections of ASTM specification B 229.
4. ACSR (aluminum cable, steel reinforced) conductors shall be 7 strand (6 aluminum around 1 steel) in accordance with ASTM specification B 232.

*A double braid, Roprene or Rolene type of weatherproof wire will be supplied for the neutral conductor when specifically requested.

INSULATION

1. Polychloroprene

The power conductors shall be covered with insulating Roprene to a minimum wall thickness of at least 90% of the specified values.

The nominal thickness of insulation shall be 4/64" on sizes No. 8 to No. 2 AWG, and 5/64" on sizes No. 1 to No. 4/0 AWG.

Physical Properties of Polychloroprene

Tensile strength, min. psi	1200
Elongation at rupture, min. percent	250
Set in 2 in. gauge length, max. in.	%
Tensile strength after 96 hrs. in oxygen-bomb test, min. psi.	75% of original
Elongation at rupture after 96 hrs. in oxygen-bomb test, min. percent	65% of original
Tensile strength after 168 hrs. in air oven test @ [illegible]-71 c., min. psi	75% of original
Elongation at rupture after 168 hrs. in air oven test @ 69-71 c., min. percent	65% of original
Tensile strength after 18 hrs. in oil (ASTM-D752) @ 120-122 c., min. psi	60% of original
Elongation at rupture after 18 hrs. in oil (ASTM-D752) @ 120-122 c., min. percent	60% of original

2. Polyethylene

The power conductors shall be covered with Rolene to a minimum wall thickness of at least 90% of the specified values. The nominal thickness of insulation shall be 3/64" for sizes No. 8 to No. 2 AWG and 4/64" for sizes No. 1 to No. 4/0 AWG. Rolene insulation shall be black in color and shall be compounded to be resistant to sunlight and weathering.

Physical Properties of Polyethylene

Tensile strength, min. psi	1400
Elongation at rupture, min. percent	350
Tensile strength after 48 hrs. in air oven test @ 98-100 c., min. psi	75% of original
Elongation at rupture after 48 hrs. in air oven test @ 98-100 c., min. percent	75% of original

ASSEMBLY

One or more power conductors shall be spirally wrapped around the neutral messenger with a lay of 25 to 60 times the diameter of one of the insulated conductors. The direction of lay shall be the same as the direction of lay of wires in the neutral conductor. The resistance of the neutral conductor shall be substantially the same as that of the insulated conductor or, as an alternate, it may be the equivalent of two AWG sizes smaller for cable having a resistance less than No. 8 AWG copper. If a reduced neutral conductor is aluminum, such reduced neutral shall be ACSR unless otherwise specified.

TESTS

All finished cable shall be immersed in water for at least one (1) hour and tested at 1500 volts for one minute without failure between each insulated conductor and ground.

PUT UP

As indicated in the accompanying tabulation, unless otherwise specified on the purchase order.

3352

[fol. 6516]

GENERAL INFORMATION

on Rome's Neutral-supported Service Cable

This popular design is available in a large range of sizes with either one, two, or three insulated conductors spiraled around the generally uncovered neutral-messenger (this messenger is also available with appropriate coverings as required by local codes or standards).

The neutral size may be equal to, or smaller than, power conductors as desired.

Rome's self-supporting service drop cable is available with either copper or aluminum conductors as shown below. The conventional type of messenger may be stranded hard-drawn copper, Copperweld, hard-drawn aluminum, or ACSR (aluminum cable, steel reinforced). Various types of fittings and hardware are readily available.

Two types of special construction are available: (1) a rubber-insulated, neoprene-jacketed (so called "two-shot") construction; (2) a special cable covering for areas where tree abrasion is encountered. Further information on these and other special constructions will be supplied on request.

Power Condr. AWG	Strand	Insulation Thickness 64ths		*Messenger		Roprene Insulation		Rolene Insulation		Current Carrying Capacity See Pg. 7	Breaking Strength Pounds	Standard Put-up (Triplex)
		Roprene	Rolene	Size	Type	O.D. Inch	Weight lbs/M'	O.D. Inch	Weight lbs/M'			
Copper Conductors												
8	Solid	4	3	8 Sol. or Str.	Copper	.52	207	.45	180	60	826	1500'R (24")
8	Solid	4	3	8 C	Copperweld	.52	218	.45	191	60	1362	
6	7	4	3	6 Sol. or Str.	Copper	.63	323	.56	277	80	1228	1500'R (27")
6	7	4	3	6 C	Copperweld	.63	339	.56	295	80	2143	or 500'C
6	7	4	3	8 Sol. or Str.	Copper	.63	292	.56	248	80	826	
6	7	4	3	8 C	Copperweld	.63	303	.56	256	80	1362	
4	7	4	3	4 Strand	Copper	.72	486	.66	430	100	1938	1500'R (30")
4	7	4	3	4 A	Copperweld	.72	519	.66	467	100	3938	or 500'C
4	7	4	3	6 Sol. or Str.	Copper	.72	438	.66	383	100	1228	
4	7	4	3	6 C	Copperweld	.72	454	.66	400	100	2143	
2	7	4	3	2 Strand	Copper	.84	740	.78	672	135	3045	1000'R (30")
2	7	4	3	2 F	Copperweld	.84	758	.78	693	135	4233	
2	7	4	3	4 Strand	Copper	.84	664	.78	597	135	1938	
2	7	4	3	4 A	Copperweld	.84	697	.78	632	135	3938	
Aluminum Conductors												
6	Solid	4	3	6 Strand	All Aluminum	.58	138	.54	101	60	528	1500'R (27")
†6	Solid	4	3	6	ACSR	.58	150	.54	112	60	1170	or 500'C
4	7	4	3	4 Strand	All Aluminum	.72	215	.66	161	80	826	1500'R (30")
†4	7	4	3	4	ACSR	.72	233	.66	180	80	1830	or 500'C
4	7	4	3	6	ACSR	.72	212	.66	158	80	1170	
2	7	4	3	2 Strand	All Aluminum	.84	308	.78	240	105	1266	1000'R (30")
†2	7	4	3	2	ACSR	.84	337	.78	270	105	2790	
2	7	4	3	4	ACSR	.84	303	.78	235	105	1830	
1/0	19	5	4	1/0 Strand	All Aluminum	1.07	480	1.00	390	140	1865	1000'R (36")
1/0	19	5	4	1/0	ACSR	1.07	526	1.00	426	140	4280	
1/0	19	5	4	2	ACSR	1.07	472	1.00	382	140	2790	

*All stranded messengers are 7 wire—ACSR is 6 aluminum and 1 steel core. Special ACSR neutral constructions available upon request.

†These sizes, insulated with Roprene (neoprene), are covered by the accepted list of materials of the R.E.A. Duplex and Quadrex Cable information supplied upon request..

Overhead Triplex Secondary Cable

The use of more and more electrical appliances and equipment is making each residential customer increasingly "service conscious." Therefore, modern distribution systems must stress these features: better performance; neat appearance; lower cost.

A dependable power supply must be maintained by the servicing utility. Utilities must eliminate as many causes of service interruptions as possible. One of the major problems is tree damage to the power lines. In some cases, trimming trees to obtain greater clearance between tree and line or providing wider pin spacing can reduce the danger of tree damage.

But, in densely wooded areas, where tree-trimming is expensive, or in areas where tree-trimming is restricted, the use of high quality polyethylene or neoprene covered wire (such as overhead triplex secondary cable) offers the best protection against this cause of service interruptions.

The use of overhead triplex secondary cable is growing rapidly. While the material costs are somewhat higher than open-wire systems, they are usually more than offset by the reduction in installation time that is required. The neater appearance of triplex secondary systems has received good public acceptance. With this system there is an improvement in voltage regulation as a result of reduced reactance. Flicker voltage problems are minimized and the customer gets a higher average voltage.

Other advantages of overhead triplex secondary cable as compared to conventional open-wire systems are as follows:

1. Flexibility of transformer-secondary layout.
2. Less pole space is required. Normally a 35-foot pole can provide space for a transformer installation and clearance to telephone attachments. Open-wire secondaries require 40-foot poles.
3. Greater resistance to storm damage.
4. Overhead triplex secondary cable will support its services within reaching distance of the poles or in mid-span, thereby leaving the pole free of service attachments. This provides a safer pole for future maintenance work by allowing free climbing and more working area.
5. Long spans can be used because they are independent of services.

Secondary cable may also be installed in the field by using a "spinner." The spinner lashes two, three, or four single wires to an installed messenger. The messenger is first strung from the poles by means of an open saddle-type suspension clamp. The phase conductors are then pulled in and as the spinner or lashing machine is pulled along the messenger, the drum containing the lashing wire rotates around the entire assembly, binding the insulated conductors tightly to the messenger.

The most difficult problem of the overhead triplex secondary cable program has been mid-span tapping. However, newly developed clamps and connectors are now available to provide a solution to this problem. The following examples of tapping devices are offered for your information.

R. M. Grogan, Long Island Lighting Co., "Development and Experience with Aerial Triplex Cable Secondary," (Chicago, Ill., April 1956)

A. A. Hill, Jr., Baltimore Gas & Electric Co., "Distribution Costs Lowered with Triplex Secondary Bus," (Electrical South, Nov. 1956)

F. T. Nessle, Long Island Lighting Co., "New Design for Secondary System," (Electrical World, July 1955)

Sam J. Pearson, Portland General Electric Co., "Cabled Aluminum Secondaries," (Electric Light & Power, March 1953)

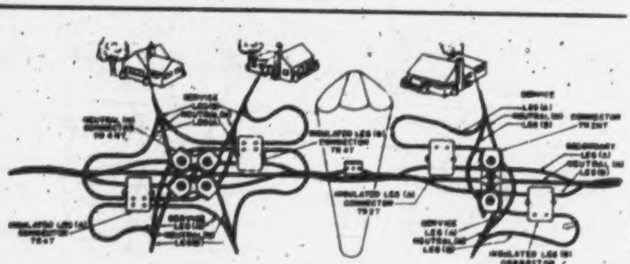
T. A. Phillips, Arizona Public Service Co., "Make Economical Distribution," (Electric Light & Power, Nov. 1953)

E. R. Stroud, Delaware Power & Light Co., "Aerial Cable Solves Feeder Problem," (Electrical World, July 1954)

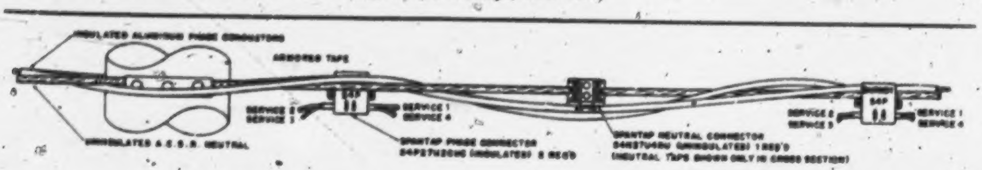
Charles N. Wyatt, Oklahoma Gas & Electric Co., "The Use of Aerial Cable for Secondary," (Kansas City, Mo. April 1956)

TRIPL-X-TAP 3-unit Connector

Two insulated connectors plus a neutral connector comprise the compact, low cost TRIPL-X-TAP "package." This type of connection assures positive electrical joints and, through use of supporting neutrals, guarantees mechanical permanence.



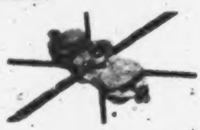
(Diagrams and photo courtesy of Dossert Mfg. Corp., Brooklyn, New York)



SPANTAP INSTALLATION

Triplex secondary cable can be tapped—midspan or near the pole—economically, dependably, and neatly with connectors especially engineered for this purpose. One set of SPANTAPS—two phase units and one neutral—connects up to four Triplex services to a cabled secondary.

(Photo and diagram courtesy of Burndy Corporation, Norwalk, Connecticut)



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[fol. 6518]

GENERAL INFORMATION

on Rome Neutral-supported Secondary Cable

Triplex secondary cable consists of two insulated (neoprene or polyethylene) conductors spiraled around a suitable neutral-messenger. Conventional power conductor sizes are No. 1/0 to No. 4/0 AWG aluminum, while the high-strength neutral-messenger may be either strandetl hard-drawn copper, Copperweld, hard-drawn aluminum, or ACSR.

The factory-assembled Triplex construction offers certain advantages for secondary use.

Elimination of cross-arms, joint pole use, reduction of hardware, ease of installation, greatly improved appearance, decreased storm vulnerability and substantially lower reactance or improved regulation, are only a few of the advantages to be realized by using secondary cable instead of open-wire construction.

Aluminum Conductors—Copperweld Neutral

Power Condr. AWG	Strand	Insulation Thickness 64ths		*Messenger		Roprene Insulation		Rolene Insulation		Current Carrying Capacity (See Pg. 7)	Breaking Strength Pounds	Standard Put-up (Triplex)
		Roprene	Rolene	Size	Type	O.D. inch	Weight lbs/M'	O.D. inch	Weight lbs/M'			
2	7	4	3	4 A	Copperweld	.84	408	.78	342	105	3938	1000'R
2	7	4	3	6 C	Copperweld	.84	343	.78	277	105	2143	(30" x 18" NR)
1/0	19	5	4	2 F	Copperweld	1.07	603	1.00	510	140	4233	1000'R
1/0	19	5	4	4 A	Copperweld	1.07	542	1.00	449	140	3938	(36" x 22" NR)
2/0	19	5	4	1 F	Copperweld	1.16	736	1.10	631	165	5266	1500'R
2/0	19	5	4	3 A	Copperweld	1.16	659	1.10	554	165	4810	(42" x 26½" NR)
3/0	19	5	4	1/0 F	Copperweld	1.26	884	1.20	776	190	6536	1000'R
3/0	19	5	4	2 F	Copperweld	1.26	753	1.20	645	190	4233	(42" x 26½" NR)
4/0	19	5	4	2/0 F	Copperweld	1.38	1087	1.32	966	220	8094	1000'R
4/0	19	5	4	1 F	Copperweld	1.38	921	1.32	801	220	5266	(42" x 26½" NR)

Aluminum Conductors—ACSR Neutral

Power Condr. AWG	Strand	Insulation Thickness 64ths		*Messenger		Roprene Insulation		Rolene Insulation		Current Carrying Capacity (See Pg. 7)	Breaking Strength Pounds	Standard Put-up (Triplex)
		Roprene	Rolene	Size	Type	O.D. inch	Weight lbs/M'	O.D. inch	Weight lbs/M'			
†2	7	4	3	2	ACSR	.84	337	.78	270	105	2790	1000'R
2	7	4	3	4	ACSR	.84	303	.78	235	105	1830	(30" x 18" NR)
1/0	19	5	4	1/0	ACSR	1.07	526	1.00	426	140	4280	1000'R
1/0	19	5	4	2	ACSR	1.07	472	1.00	382	140	2790	(36" x 22" NR)
2/0	19	5	4	2/0	ACSR	1.16	638	1.10	536	165	5345	1500'R
2/0	19	5	4	1	ACSR	1.16	570	1.10	468	165	3480	(42" x 26½" NR)
3/0	19	5	4	3/0	ACSR	1.28	761	1.23	653	190	6675	1000'R
3/0	19	5	4	1/0	ACSR	1.26	675	1.20	568	190	4280	(42" x 26½" NR)
4/0	19	5	4	4/0	ACSR	1.41	931	1.35	810	220	8420	1000'R
4/0	19	5	4	2/0	ACSR	1.38	823	1.32	802	220	5345	(42" x 26½" NR)

*All stranded messengers are 7 wire—ACSR is 6 aluminum and 1 steel core. Special ACSR neutral constructions available upon request.

†These sizes, insulated with Roprene (neoprene), are covered by the accepted list of materials of the R.E.A. Duplex and Quadrex Cable information supplied upon request.

Sag and Tension Data—Three Conductor (Neoprene) Neutral-supported Secondary and Service Drop Cable

Cable Size	Brk'ng Str. Pounds	Span Feet	LIGHT LOADING				MEDIUM LOADING				HEAVY LOADING			
			Final Stringing		Final Loaded		Final Stringing		Final Loaded		Final Stringing		Final Loaded	
			Sag In. 60° F	Tension Pounds 60° F	Sag In. 30° F	Tension Pounds 30° F	Sag In. 60° F	Tension Pounds 60° F	Sag In. 15° F	Tension Pounds 15° F	Sag In. 60° F	Tension Pounds 60° F	Sag In. 0° F	Tension Pounds 0° F
Aluminum Conductors—Aluminum Neutral														
6 AWG Power Conductors—6 AWG Aluminum Neutral	525	125	42	85	48	265	66	55	70	260	—	—	—	—
4 AWG Power Conductors—4 AWG Aluminum Neutral	825	125	29	175	36	413	45	110	50	413	80	60	81	413
2 AWG Power Conductors—2 AWG Aluminum Neutral	1266	125	27	270	31	560	33	220	37	633	57	125	60	633
1/0 AWG Power Conductors—1/0 AWG Aluminum Neutral	1865	125	28	395	31	745	30	365	33	870	47	240	48	933
Aluminum Conductors—ACSR Neutral														
4 AWG Power Conductors—4 AWG ACSR Neutral	1830	75	6	345	9	565	7	295	12	636	8	249	16	787
		100	10	352	16	607	12	310	19	705	13	274	24	896
		125	15	369	22	678	17	329	27	774	25	230	38	915
2 AWG Power Conductors—2 AWG ACSR Neutral	2790	75	6	508	8	806	7	438	10	888	8	368	13	1055
		100	10	529	13	863	12	456	16	967	13	406	21	1180
		125	15	541	20	906	17	486	23	1046	18	447	30	1301
1/0 AWG Power Conductors—1/0 AWG ACSR Neutral	4280	100	10	789	12	1245	11	694	15	1352	13	604	18	1622
		125	15	820	18	1305	17	728	28	1451	18	662	26	1770
		150	22	860	26	1370	23	770	45	1540	25	706	35	1910
Aluminum Conductors—Reduced ACSR Neutral														
4 AWG Power Conductors—6 AWG ACSR Neutral	1170	50	6	227	14	354	8	199	16	535	5	160	11	508
		100	14	238	20	450	16	210	23	585	28	118	37	585
		150	29	254	41	522	36	192	49	585	76	100	84	585
2 AWG Power Conductors—4 AWG ACSR Neutral	1830	75	6	360	10	590	9	306	14	651	10	262	17	810
		100	13	368	18	630	14	326	21	728	16	290	26	927
		125	20	375	26	670	21	343	32	791	24	299	37	1010
1/0 AWG Power Conductors—2 AWG ACSR Neutral	2790	100	14	505	16	880	14	496	18	1003	13	413	22	1228
		150	19	575	24	960	29	544	36	1155	26	474	41	1477
		200	43	625	46	1043	48	590	58	1280	43	523	64	1690

Current Carrying Capacities

The current carrying capacities shown in the columns on page 4 and page 6 are in accordance with IPCEA recommendations. These capacities are based upon 75°C maximum continuous conductor temperature and 40°C ambient air temperature.

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[fol. 6520] **Sag and Tension Data—Three Conductor (Neoprene) Neutral-supported Secondary and Service Drop Cable**

Cable Size	Brk'ng Str. Pounds	Span Feet	LIGHT LOADING				MEDIUM LOADING				HEAVY LOADING			
			Final Stringing		Final Loaded		Final Stringing		Final Loaded		Final Stringing		Final Loaded	
			Sag In. 60° F	Tension Pounds 60° F	Sag In. 30° F	Tension Pounds 30° F	Sag In. 60° F	Tension Pounds 60° F	Sag In. 15° F	Tension Pounds 15° F	Sag In. 60° F	Tension Pounds 60° F	Sag In. 0° F	Tension Pounds 0° F
Aluminum Conductors—Copperweld Neutral														
6 AWG Power Conductors—8C Copperweld Neutral	1362	50	2	409	4	514	2	409	5	570	2	409	7	675
		100	6	409	14	568	6	409	17	666	15	180	29	681
		150	14	409	28	633	19	306	38	681	51	117	65	681
4 AWG Power Conductors—6C Copperweld Neutral	2143	50	2	643	3	796	2	643	4	880	2	643	6	998
		100	6	643	12	848	6	643	14	965	8	495	21	1072
		150	14	643	24	925	14	643	28	1068	30	308	47	1072
4 AWG Power Conductors—8C Copperweld Neutral	1362	50	2	409	5	525	2	409	6	586	2	387	7	681
		100	9	409	17	587	9	404	19	681	20	177	32	681
		150	20	409	32	675	27	290	43	681	61	135	73	681
2 AWG Power Conductors—4A Copperweld Neutral	3938	50	2	1181	3	1310	2	1181	3	1420	2	1181	4	1680
		100	5	1181	7	1469	5	1181	10	1605	5	1181	14	1828
		150	12	1181	18	1510	12	1181	21	1695	12	1111	29	1969
2 AWG Power Conductors—6C Copperweld Neutral	2143	50	2	643	4	800	2	643	4	894	2	643	6	1010
		100	8	643	13	872	8	643	15	990	11	490	23	1072
		150	18	643	26	995	21	559	32	1072	38	308	51	1072
1/0 AWG Power Conductors—2F Copperweld Neutral	4233	100	7	1270	10	1650	7	1270	12	1825	7	1255	14	2117
		150	16	1270	21	1705	16	1270	23	1940	20	1005	32	2117
		200	29	1270	36	1772	29	1270	40	2010	44	825	58	2117
1/0 AWG Power Conductors—4A Copperweld Neutral	3938	100	7	1181	10	1490	7	1181	12	1636	7	1181	16	1895
		150	12	1181	22	1570	12	1181	22	1760	18	1000	34	1969
		200	28	1181	38	1630	28	1181	42	1855	41	806	60	1969
2/0 AWG Power Conductors—1F Copperweld Neutral	5266	100	7	1580	9	2018	7	1580	10	2250	7	1580	13	2570
		150	16	1580	20	2075	16	1580	25	2350	18	1405	28	2633
		200	28	1580	34	2134	28	1580	37	2460	37	1200	51	2633
2/0 AWG Power Conductors—3A Copperweld Neutral	4810	100	7	1443	10	1810	7	1443	11	1955	7	1443	14	2280
		150	16	1443	21	1880	16	1443	23	2080	17	1345	30	2405
		200	28	1443	36	1925	28	1443	39	2160	34	1175	53	2405

ROME CABLE
CORPORATION

[fol. [illegible]] In United States District Court

Defendants' Exhibit [illegible]

Guide to representative

Wire, Cable and Conduit

ROME CABLE
DIVISION OF ALCOA

[fol. 6592]

Bare and Weatherproof Wire

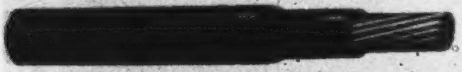
Bare copper wire, aluminum, or ACSR in all tempers—sizes up to 1500 MCM.

Weatherproof wire—Roprene (neoprene), Rolene (polyethylene), or URC types. Conductors may be copper, aluminum, or ACSR. Roprene and URC types are also available in handy 500-foot coils packed in individual cartons—sizes 14 through 4 AWG soft copper.

Magnet Wire

Round, square, and rectangular with insulations of cotton, paper, glass, dacron and glass, silicone-treated glass and high-temperature enamel.

Building Wire

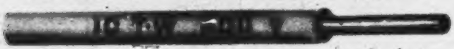


Rubber and Braided or Neoprene Jacketed — 600 volts, Type RHW, for wet or dry installations—75 C.

Rubber and Braided or Neoprene Jacketed — 600 volts, Type RHH for dry installations—90 C.

Thermoplastic Insulated — 600 volts, Type THW, for wet or dry installations—75 C.

All types are available with solid or stranded, copper or aluminum conductors, in the complete range of standard sizes.



Thermoplastic Building Wire—600 volts. Type TW. Rome Synthinol, a polyvinyl chloride thermoplastic used on building wire, is approved by U/L for use in wet or dry locations at 60 C. It is highly resistant to heat, sunlight, oils, acids, alkalies, moisture, and flame.

Synthinol 901 is a special PVC compound developed specifically for wiring in Chemical Plants, Oil Refineries, Paper Mills, and other industrial "hot spots" where additional resistance to heat, oil, and chemical hazards is needed.

- U/L approved as Type TW for 60 C under the National Electrical Code
- U/L approved as appliance lead wire for 600 volts at 105 C on sizes 28 through 8 AWG and at 90 C on sizes 6 through 4/0 AWG.
- Conforms to standards of the National Machine Tool Builders Association for machine tool wire.

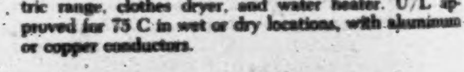
Nonmetallic Sheathed Cable — 600 volts. Rome Roflex—Type NM. Two and three conductors, with or without ground, insulated with a high-quality Synthinol thermoplastic compound, covered with an over-all braid and an improved nonflaking finish. Sizes 14 through 4 AWG. U/L approved.

Multipurpose Nonmetallic Sheathed Cable — 600 volts. Rome FlexAll—Types UF and NMC. Approved by Underwriters as underground feeder and branch circuit cable, and nonmetallic sheathed cable — corrosive-resistant. Rome FlexAll is particularly recommended for between-building wiring in farm, industrial, and residential yard lighting and interior wiring of livestock buildings, dairies, breweries, packing houses, cold storage, and ice plants.

Rome FlexAll, single conductor, comes in sizes 14 through 4/0 AWG. Two- and three-conductor FlexAll is made in sizes 14 through 10 AWG and is available with or without ground wire.

Service Cables

Service Entrance Cable—600 volts. Type SE, Style U. Rome Type SE, Style U, Service Entrance Cables are designed for long life and neat appearance. Specifically recognized by the NEC for attachment to the side of the building from the weather-head to the meter equipment, Rome Type SE cable may also be used from the pole to the meter as well as from the meter to the electric range, clothes dryer, and water heater. U/L approved for 75 C in wet or dry locations, with aluminum or copper conductors.

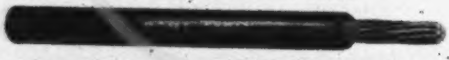


Self-Supporting Service Drop and Secondary Cable. Embodies the time-proven construction of insulated power conductors spiraled around a bare neutral for mechanical support. Power conductors are Roprene (neoprene) or Rolene (polyethylene) insulated. Power conductors and neutral messengers may be copper, aluminum, or ACSR. Copperweld neutrals are also available. Rome Cable manufactures a special self-supporting cable for overhead distribution where tree conditions are a problem.

ROME CABLE DIVISION

[fol. 6523]

Machine Tool and Control Wire



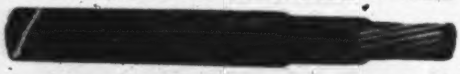
A wire insulated with Rome Synthinol, designed for the wiring of automatic machine tools and control circuits. This product has superior characteristics of long life, high resistance to heat, oils, chemicals, and solvents and uniformly small diameters for more room in tight places. Available in sizes 18 AWG through 4/0 AWG with thermoplastic insulation of clear permanent colors. Rome Synthinol Machine Tool Wire is U/L approved for use at 60 C where exposed to oil; and 90 C on switchboards and in appliances where exposed to air. Conforms to National Machine Tool Builders Association Standards. Voltage rating, 600 volts.

Hook-up Wires

Rome Cable manufactures a broad line of hook-up and appliance wires with both rubber and thermoplastic insulations in a wide range of sizes for commercial and military uses. Outer coverings are available in the form of a transparent nylon sheath or treated braids of cotton, rayon, nylon, or glass.

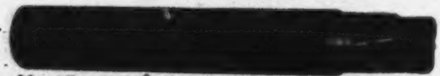
Power Cables

For aerial, duct, raceway, or direct-in-earth installation.



Romarine-Roprene. This combination of conductor, heat- and moisture-resistant rubber insulation, and neoprene sheath is a multipurpose power distribution and service entrance cable—generally recommended for 600-volt service. Romarine-Roprene may be installed aerially, on open racks, in ducts, or by direct earth burial. U/L approved as Type USE.

Ozone-resistant Cables for High Voltage. Rozone (oil-base) and Rozone A (butyl-base) are both recommended for high-voltage applications where stability of electrical characteristics and exceptionally long life are factors. Manufactured for service up to 15 KV, these cables combine superior ozone resistance with the ruggedness of Roseal—a special flame-retarding polyethylene—or a Roprene sheath. Other sheathing materials are also available. Power cables are manufactured in a full range of sizes as single-, two-, or three-conductor, shielded or unshielded in accordance with industry or customer standards.



Mine Power and Industrial Feeder Cable 0-5000 volts. Type MPT. Rome Type MPT Mine Power and Industrial Feeder Cable is a new economical and easy-to-handle, nonmetallic sheathed power cable with included ground wires for mine feeder and industrial service. Insulated with polyethylene and sheathed with Roseal (flameproof polyethylene), it is less expensive, lighter in weight, and smaller in diameter than conventional rubber and neoprene types which are also available.

Interlocked Armor Cable. Rome Interlocked Armor Cable is available in sizes No. 8 AWG to 750 MCM with copper or aluminum conductors in voltage ratings up to 15 KV. The Armor may be aluminum, bronze, or galvanized steel—insulation may be Rozone (oil-base), Rozone A (butyl-base), Romarine (RH-RW), Synthinol, or polyethylene.

Preassembled Aerial Cable. Individually insulated power conductors are cabled together and bound to a bare Copperweld messenger. Rome's standard design for this product utilizes a reverse lay. As the name suggests, the lay of the power conductors is reversed at regular short distances — approximately every five feet. This reversed lay provides built-in slack to facilitate easy mid-span tapping—even when the circuit is "hot."

The installation of this type cable relieves wire congestion on poles, eliminates or greatly reduces tree trimming, and provides continued service during storm hazards.

Portable Cords and Cables

Portable Cords. Rome Cable offers two grades of portable cords. Rome 50 Types SO and SJO cords are synthetic-rubber-insulated and Roprene (neoprene) sheathed for regular service, while premium Rome 60 cord is mold-cured for extra tough service in hazardous locations. Both, Rome 50 and Rome 60 cords are U/L approved.

Rome 60 Portable Power Cables. Round Types W and G. Round multiple-conductor Type W cables are

made up with the specified number of flexible, color coded insulated conductors, assembled and protected over all by a reinforced sheath of neoprene.

Type G cables are similar in construction to Type W cables except that grounding conductors are placed in the interstices of the cable assembly. These cables are designed for use as trailing cables where extra flexibility is required. Each length carries the symbol P-105-BM, denoting compliance with Federal and Pennsylvania Bureau of Mines Safety Codes.

ROME 60 PARALLEL DUPLEX MINING MACHINE CABLE. Rome 60 flat twin mining machine cable consists of two heat-resistant synthetic rubber insulated and braid reinforced conductors laid parallel, separated by a "web," and sheathed with a rugged neoprene jacket. Flat twin Type W cable, without grounding conductor, is used on track-mounted equipment in ungrounded systems. Flat twin Type G cable, with grounding conductor, is used for portable and rubber tired equipment where grounding is required. Type G cable is similar in construction to Type W cable except that a braid-covered flexible grounding conductor is located between the two insulated power conductors. These cables are relatively small in diameter, flexible, easy to handle, and offer maximum resistance to physical abuse. The molded inscription, P-105-BM, denotes compliance with Federal and Pennsylvania Safety Codes.

Street Lighting Cables

Rome Cable offers a variety of street lighting cables for underground or overhead wiring of series and multiple lighting systems. Insulations may be of rubber or thermoplastic compounds protected with economical nonmetallic jackets, shielding, or lead sheath as required.

POLE AND BRACKET CABLE—4001 to 10000 VOLTS, Open Circuit. An improved construction, offering small diameter and low cost. Nonrotting, clean, neat, easy to use. Unaffected by moisture, ozone, and weather. Insulated with Rome Synthinol (polyvinyl chloride) with an over-all sheath of Roleue (polyethylene). Recommended for the interior wiring of ornamental poles or exterior wiring of pole-type bracket fixtures.

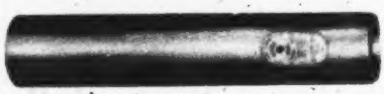
Instrumentation, Station Control, Supervisory and Signal Cables

Instrumentation cables are specially designed and built in a variety of constructions for telemetering and data transmission.

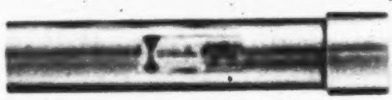
STATION CONTROL CABLES—600 VOLTS. Rome Cable is a leader in the manufacture of station control and supervisory control cables. Sound engineering, experience and modern manufacturing facilities enable Rome Cable to produce a variety of constructions. Some typical constructions utilize (1) Rozone insulation with Ropene sheath (Type CRO-1), (2) Romarine insulation with Ropene sheath (Type CRM-1), and (3) all-thermoplastic construction (Type CT-2) (Type CT-B) (Type CT-C).

SIGNAL CABLES — IMSA TYPES, 600 VOLTS. Rome Cable regularly supplies cables in conformance with IMSA Specifications No. 1, 3, 4, 5, 19, and 20. The popular Type FB, Specification No. 5, embodies moisture resistant insulation (Romarine) and a nonmetallic sheath (Ropene).

Conduit



ROME EMT Electrical Metallic Tubing. A superior thin wall steel conduit. Solid electrogalvanized zinc exterior finish resists corrosion and abrasion. Mirror smooth interior makes fishing and pulling easy. Underwriters approved.



Alcoa Aluminum Conduit offers many advantages such as light weight, low cost, good appearance, corrosion resistance, non-sparking, non-magnetic, easy installation and is Underwriters approved.

3377 (2)

[fol. 6541] (SALES DEPT. COPY)

Engineering Department
Recommendations for Quoting

Number 300
Inquiry No. (Cont.)
Date 11/26/58

Customer
Ultimate User
Spec. or Correspondence References

RECOMMENDED CONSTRUCTION DETAILS

ITEM 3 — 15000 FT — 2/c - # 2/0 AWG - Copper - Preassembled Aerial Power Cable - STK Code 03-1712

2/c - # 2/0 AWG - 37/STR - Tinned - Copper
4/64" Performance Insulation (2361)
2/64" Roprene Sheath (6065) - Ridge Ident.
O.D. .624

.624 × 2 = 1.248

Assembly - 2/c - # 2/0 AWG Twisted with reverse lay and bound to a 4D - EHS - 30% Cond. Copperweld messenger with an .040 x .375 soft copper binder strap. -

1.248 + .348 + .080 = 1.676
1.248 + .080 = 1.328

O.D. 1.33" x 1.68"

P.U. 1000 FT (± 100 FT) on 54" Reel.

ITEM — 15000 FT — 2/c - # 4/0 AWG - Aluminum - Preassembled Aerial Power Cable - STK Code 03-1733.

2/c cond. # 4/0 AWG - 37/STR - EC H26 Alum (3/4 Hd)
5/64 Performance Insulation (2361)
3/64 Roprene Sheath (6065) Ridge Ident.
O.D. .797

.549 + .156 + .094 = .799
.008
.010
.797 × 2 = 1.594

2/c - # 4/0 AWG Twisted with reverse lay and bound to a 4D - EHS - 30% Cond. Copperweld Messenger with an .040" x .375" soft copper binder strap

1.594 + .080 = 1.674
1.674 + .348 = 2.022

O.D. 1.67" x 2.02"

P.U. 1000 FT (± 100 FT) on 60" Reel.

Prepared by: R. H. Beauchamp

[fol. 6542] **3378** ROME CABLE CORPORATION
TWX MESSAGE
ROME, N. Y. 8078

To Buck

phone 12/4

Date 12/4

Refer Public Service Elec + Gas NY-665-C - revise price item 3 to $850.00 net - if unable to revise pull your quotation

[fol. 6543]

3379 December 1, 1958

Public Service Elec. & Gas Company
80 Park Place
Newark 1, New Jersey

Attention: Mr. J. J. Coleman, Buyer

Gentlemen:

In response to your form letter inquiry dated November 24th covering Cable, Self-Supporting Secondary, we are pleased to quote as follows:

Specification No. 84-1 - Copper
Specification No. 85-1 - Aluminum

Stock Code		Description	Quantity - Feet	Price M' Net
03-1808 or	#1	3/cond. - Copper	30,000	$1080.00
03-1739	#2/0	3/cond. - Aluminum		$1204.00
03-1712 or	#2/0	2/cond. - Copper	15,000	$ 502.00
03-1733	#4/0	2/cond. - Aluminum		$ 792.00

Delivery: F.O.B. Destination
Terms: ½ of 1% 10 days, net 30
Shipment: Approx. 7 weeks lead time required.

The terms and conditions appearing on the reverse side are to be considered a part of this quotation. Prices stated herein shall be subject to adjustment to the Company's prices in effect on date of shipment. However, such prices shall not exceed any lawful ceiling prices established and in effect at the time of shipment.

Very truly yours,

ROME CABLE CORPORATION

WSW:DSB

W. S. Williams

December 5, 1958

Public Service Elec. & Gas Company
80 Park Place
Newark 1, New Jersey

Attention: Mr. J. J. Coleman, Buyer

Gentlemen:

In connection with our quotation letter dated December 1st, we wish to confirm our conversation of December 4th in which we asked that you kindly revise figure on Item 3 as follows:

Stock Code	Description		
		Revise From:	$502.00/M'
03-1712	#2/0-2/cond. - Copper	To:	$850.00/M'

All other terms and conditions to remain as originally quoted.

We thank you for permitting us to make this revision and remain,

Very truly yours,

ROME CABLE CORPORATION

W. S. Williams

WSW:DSB

3381

[fol. 6545] In United States District Court

Defendants' Exhibit 38

Request for Quotation

I. C. Q. D. File (Customer)

INQUIRY NO. NY-839-C

FROM: NEW YORK DISTRICT

DATE: 11/5/38

TO: CENTRAL QUOTATION DEPT., ROME, N.Y.

INQUIRY FROM: PUBLIC SERVICE ELEC. & GAS CO.

FOR SHIPMENT TO:

U. S. Dis. Cour. S. D. N. Y.
Ex No. AR 3891
Gov't ☐ Pl'f ☐ Def ☐

— THE FOLLOWING MATERIAL —

"We shall be pleased to receive your quotation not later than Nov. 12, 1938 for furnishing on a commitment basis the following 4KV self-supporting cable, to be manufactured to either our Spec. No. 14-2, Aluminum or Spec. No. 22-4, copper:

Stock Code		Quantity-Feet	Price M ft.
03-1524	#4 3/cond. copper	30,000	$1210.00
03-1549	#2/0 3/cond. Alum.	10,000	$1488.00
or similar to 03-1524	#1 3/cond. copper	10,000	$1665.00
03-1528	#2/0 3/cond. copper	10,000	$2260.00
or 03-1550	#4/0 3/cond. aluminum	10,000	$1986.00
03-1530	#4/0 3/cond. copper	10,000	$3010.00
or 03-1560	397,500cm 3/cond. alum.	10,000	$3755.00
03-1533	350MCM 3/cond. copper	40,000	$4290.00
or 03-1565	600MCM 3/cond. alum.	40,000	$4280.00
03-1534	500MCM 3/cond. copper	5,000	$5710.00
or 03-1538	800MCM 3/cond. alum.	5,000	$5110.00

Delivery to New Jersey points in Public Service territory.
Please quote estimated lead time in weeks."

W.S.WILLIAMS:DSB

TERMS: (Standard discount dates apply)
☒ ½ of 1% ☐ 2% Other

Distributor Comm. if any
☐ Net ☐ 5% Other

☐ Competitive Report Requested

Shipment if other than mill condition sheet 7 weeks

F. O. B. Destination unless otherwise noted.

gab:mab

G.A. Brodock

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

	Size	Ins	Roebling	Last quote	[illegible]
20 000	3/c 4 cap	40	1424	1310	1010
10 000	3/c 2/0 alum	40	1458 / 1411	[illegible]	
10 000	3/c 1 cap	40	1962	1800	[illegible]
30 000	3/c 2/0 cap	7/16	2660		
[illegible]	3/c 4/0 alum	7/16	1986 / 1942		
10 000	3/c 4/0 cap	7/16	3551	3274	2880
10 000	3/c 397.5 alum	7/16	3755 / 3413	3430	
40 000	3/c 350 cap	7/16	5049	4668	3340
40 000	3/c 600 alum	7/16	4901	4291	
5 000	3/c 500 cap	7/16	6467	5990	5181
500	3/c 800 alum		5105	5105	

1424 / 1310

2066 / 109 / 1962 2800 / 140 / 2660 3738 / 187 / 3551 5315 / 266 / 5049 6808 / 341 / 6467

1535 / 77 / 1458 2091 / 105 / 1986 3593 / 180 / 3413

1962 2660

3551 5049

6467 / 470 / 5997

3/0 alum

1405 1535 2091 1876

5710

[fol. 6547]

3383

[illegible] [illegible] [illegible]clock — [illegible]

"/7/5.

Gl[illegible] —

See [illegible] [illegible] at top of EBR [illegible] reference to EBR-253
N.Y. [illegible] - 618-C

The two items on the EBR-253 are the same as
item 2 } on this
item 3 { EBR-[illegible]

Am giving you this information as this may save you some work —

Earl

[fol. 6548] **3384** (SALES DEPT. COPY)

Engineering Department
Recommendations for Quoting

Number: 276
Inquiry No. NY - 639-C
Date: 11/7/58

Customer: Public Service Elec. & Gas Co. –
Ultimate User: New Jersey –
Spec. or Correspondence Reference: Spec. 14-2 Alum (or) 22-4 Copper –
(See EAR-253 (NY-613-C) dtd 10/24/58 for complete write up outline, (same as items 2 and 3 below)

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1 General Description – All items. – 5 KV, Aerial Cable.
3/c – Tinned Copper Strd (or) EC H 2 6 Alum (3/4 Hd), S.C. Tape, Butyl Ins. (65 –
Neoprene Sheathed (9055), Ridge identification marker tape under S.C. Tape, assembled with reverse lay, bound to a copper weld messenger with soft copper binder strap. –

Item No	Stock Code	Quantity	No Condrs	Size AWG	Strand & Type	Ins Thk	Sh'd Thk	Twists Between Recr' ...	Size Mess.	O.D. Nom.	P.U.
1	03-1527	30.000'	3	#4	19/Str. Cop.	10/64	5/64		4 D	2.07"	1000' - 60" R.
2	03-1549	10.000'	3	#2/0	37/Str. Alum	10/64	5/64		4 D	2.41"	1000' – 72" R
3	03-1534	10.000'	3	#1	37/Str. Cop.	10/64	5/64		4 D	2.22"	1000' - 72" R
4	03-1528	10.000'	3	#2/0	37/Str. Cop.	10/64	5/64		7/16" ⊕	2.50"	1000' - 78" R.
5	03-1550	10.000'	3	#4/0	37/Str. Alum	10/64	6/64		7/16" ⊕	2.80"	900' - 78" R
6	03-1530	10.000'	3	#4/0	37/Str. Cop.	10/64	6/64		7/16" ⊕	2.80"	900' - 78" R
7	03-1560	10.000'	3	397.5 MCM	61/Str. Alum	11/64	6/64		7/16" ⊕	3.30"	750' - 78" R
8	03-1533	40.000'	3	350 MCM	61/Str. Cop.	11/64	6/64		7/16" ⊕⊕	3.21"	750' - 78" R
9	03-1585	40.000'	3	600 MCM	91/Str. Alum	11/64	6/64		7/16" ⊕⊕	3.67"	600' - 78" R
10	03-1534	5.000'	3	500 MCM	61/Str. Cop.	11/64	6/64		7/16" ⊕⊕	3.50"	700' - 78" R
11	03-1535	5.000'	3	800 MCM	91/Str. Alum	11/64	6/64		7/16" ⊕⊕	3.97"	500' - 78" R.

⊕ 7/strand, 30% High Strength Copperweld
⊕⊕ 7/strand, 30% Extra High Strength Copperweld

NOTE: Messenger to extend five (5) feet beyond the end of the conductor for use in pulling the cable. –

Prepared by: [signature]

[fol. 6549]

2 R CG 11/7/58 PM G 3385

STEW.

REF STEINER 3/ C 2 SH- D 5 KV 49 STRD 8424.00 133 STRD 8550.00

- ROME 60 LIST OUR WEIGHTS ARE NET , SIMPLEX GROSS

BRODOCK

EEEEDDEEDEEEDDEEEDEEEDEEE GA WITH ROME 7 XXX 8078

Ref. Steiner 3/c 2 SH. D 5KV 49 strd 8424.00 133 strd 8550.00 - Rome 60 list: Our weights are net, Simplex Gross.

6 CGR 11-6-58 PM LW

BRODOCK

WANT PRICE FOR STEINER ON 1500 FT 2 3 CONDR 5 KV TYPE SHD ALSO 1500 FT 4 3 CONDR DITTO CONFIRM WEIGHTS PER M FT ARE THOSE SHOWN ON PAGE 19 ROME CATALOGUE NET WEIGHTS THEY DO NOT AGREE WITH SIMPLEX PLS TWX FRI SURE

STEW

[fol. 6550] 3386

November 11, 1958

Public Service Elec. & Gas Company
80 Park Place
Newark 1, New Jersey

Cable: Self-Supporting 4KV

Attention: Mr. J. J. Coleman, Buyer

Gentlemen:

In response to your form letter inquiry dated November 3rd, we are pleased to quote as follows:

To be manufactured to either Spec. 14-2, Aluminum or Spec. 22-4, Copper

Stock Code	Description	Quantity - Feet	Price M' Net
03-1524	#4 - 3/cond. copper	30,000	$1210.00
03-1549	#2/0 3/cond. aluminum	10,000	$1488.00
OR			
03-1524	#1 3/cond. copper	10,000	$1665.00
03-1528	#2/0 3/cond. copper	10,000	$2260.00
OR			
03-1550	#4/0 3/cond. aluminum	10,000	$1986.00
03-1530	#4/0 3/cond. copper	10,000	$3010.00
OR			
03-1560	397,500cm 3/cond. aluminum	10,000	$3755.00
03-1533	350MCM 3/cond. copper	40,000	$4290.00
OR			
03-1565	600MCM 3/cond. aluminum	40,000	$4280.00
03-1534	500MCM 3/cond. copper	5,000	$5710.00
OR			
03-1538	800MCM 3/cond. aluminum	5,000	$5110.00

Delivery: F.O.B. Destination
Terms: ½ of 1% 10 days, net 30
Shipment: Approx. 7 weeks after receipt of order at our plant.

The terms and conditions appearing on the reverse side are to be considered a part of this quotation.

[fol. 6551]

To: Public Service Elec. & Gas Company

November 11, 1958

Prices stated herein shall be subject to adjustment to the Company's prices in effect on date of shipment. However, such prices shall not exceed any lawful ceiling prices established and in effect at the time of shipment.

Very truly yours,

ROME CABLE CORPORATION

D

W. S. Williams

WSW:DSB

3388

DEFENDANTS' EXHIBIT 39

2. C. Q. D. FILE (Customer)

Request for Quotation

INQUIRY NO. NY-362-C

FROM: NEW YORK DISTRICT DATE: 1/27/58

TO: CENTRAL QUOTATION DEPT., ROME, N. Y.

INQUIRY FROM: CON EDISON

FOR SHIPMENT TO:

— THE FOLLOWING MATERIAL —

Inv. to Bid C-197 - 1/24/58
Bid due: 2/3/58

$2850.00

65,000 ft. 3 x 4/0 AWG copper @r-rubber $2890.00 M ft. 5KV Self-Supporting Aerial Cable #572-2

65,000 ft. 3 x 300MCM aluminum or rubber neoprene 5KV Self-Supporting Aerial Cable #253A-2 @ - - - $2510.00 M ft.

[illegible]

On 1000 ft. rls. State flange diameter and max. outside width of reels you would furnish

State max. lgths. you can furnish on reels that do not exceed the following dimensions. What are the dimensions of the reels you would use.

1.	Flange	Dia.	96"	Max.	Outside	Width	50"
2.	"	"	84"	"	"	"	48"
3.	"	"	72"	"	"	"	65"

The cable is to furnished per our Spec. No. EO-11-1 App. "C" dated 10/14/57 except insulated condrs. shall be cabled together with reverse lay.

State price of copper and aluminum and pulling eye.

Delivery required 2Q58.

E.T.DUCKENMAIER:DSB

TERMS: (Standard discount dates apply) ☐ ½ of 1% ☐ 2% Other______

Distributor Comm. if any ☐ Net ☐ 5% Other______

☐ Competitive Report Requested

Shipment if other than mill condition sheet______

F.O.B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

3389

[fol. 6553]

2, C. Q. D. FILE (Customer)

Request for Quotation

INQUIRY NO. NY-362-C

FROM: New York Office DISTRICT

DATE: Feb. 10, 1958

TO: CENTRAL QUOTATION DEPT., ROME, N. Y.

INQUIRY FROM: Consolidated Edison Co.

FOR SHIPMENT TO:

— THE FOLLOWING MATERIAL —

-2-

In accordance with our various phone conversations, we advised you that if you could in any way revise the price on the aluminum from $2510.00 M ft. to $2300.00 in the hopes of getting a portion of this business, please do so. You advised that competitive price on this item was around $2000.00. We can not as yet live with this price in view of our costs, but in an effort to get some of this type business from this account we would be willing to take some of it around $2300.00.

If you can find out who is quoting the $2000 price please pass it along to us.

gab:mab

G.A. Brodock

Beech said that he believes the same [illegible] figure would be lower [illegible] 2300 [illegible] would be in the running

TERMS: (Standard discount dates apply)
☐ ½ of 1% ☐ 2% Other________

Distributor Comm. if any.
☐ Net ☐ 5% Other________

☐ Competitive Report Requested

Shipment if other than mill condition sheet________

F.O.B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

[fol. 6554] 3390

2 R NY 2/5/58 AM GG

BUCK

REF CON EDISON NY 362 C SORRY CANNOT BETTER PRICES ON EXX

AERIAL CABLE

BRODOCK

[fol. 6555] **3391** (SALES DEPT. COPY) ①

Engineering Department
Recommendations for Quoting

Number 8296
Inquiry No. NY-362-C
Date January 30, 1958

Customer Consolidated Edison
Ultimate User
Spec. or Correspondence Reference EO-11 Ap. C

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1 65,000' 3/c #4/0 Rozone Ryprene 5 KV reverse lay aerial cable
Part No EC579-2 3/c Each
#4/0 37/str Tin Copper
2 Semi con tapes intercalated
10/64 Rozone A
6/64 Ryprene 1/c no mil. 1/c-2, +1/c-3
Tank - Corona level
Assembly
Cable together with reverse lay and Bind to 7/16" 40% CW Messenger with .040 x .375" Binder strap
Final Tank - Corona level
Put up 1000' on 78" x 48" reel
Note: Our 72" reel is the only one which meets Cust limits
Pulling Eye to be attached

.528 .313 .841 .20 .861 .237 1.098 Dia .433
Do Later 2/4/58 Per RCG
Note Also Bid 84" x 54 7/8 (max width) 1000' lengths
3380 169 3549 2850.00

Item 2 65,000' 3/c 300 mcm Rozone Ryprene 5 KV reverse lay aerial Cable
Part No EC-288 A-2 3/c Each
#300 mcm. 61/str Aluminum
2 Semi Con tapes intercalated
11/64 Rozone A
6/64 Ryprene voltage distribution 2510.00
Tank - Corona level
Assembly
Cable together with reverse lay and Bind to 7/16" 40% CW messenger with .040" x .375" Binder strap
Final Tank - corona level
Put up 750' on 78" x 48"
Note: Our 72" reel is the only one which meets Cust limits
Pulling Eye to be attached

Rush 2/4/58
1315.00 215 4130 355.00
.630 .344 .974 .20 .994 .188 1.182
Also Bid 1000' on 84" x 54 7/8" (max width)
Per RCG

Prepared by: W. R. [illegible]

[fol. 6556] 3392

Install. —

Labor 24.48

Exp. 59.77

Eng. & T 22.03

Ship 5.57 4.69

G. & A 9.5 10.54

Ins —

$121.51 saving

208356
121 51
196205

	Lab.	Exp.
Vol.	5.595	13.875
60%'s	18.169	44.150
	23.764	58.025
	103	103
	$24.48	$59.77

1.92
1.4
2.7 50

[fol. 6525] IN UNITED STATES DISTRICT COURT

Form A-7 Rev.

DEFENDANTS' EXHIBIT 34

2. C. Q. D. FILE (Customer)

Request for Quotation

INQUIRY NO. NE-1383

FROM: Boston Office DISTRICT DATE: Jan. 5, 1952

TO: CENTRAL QUOTATION DEPT., ROME, N. Y.

INQUIRY FROM: Boston Edison Co., Boston, Mass.

FOR SHIPMENT TO:

— THE FOLLOWING MATERIAL —

With reference to the attached, please quote the following construction and estimating prices:

Item 1 - 2000 ft. - 3 Condrs. #4/0 - 19 strand bare, semi-conducting tape, .220" ntrual polyethylene, bedding and shielding tapes, 6/64" RoSeal sheath; three such conductors twisted with reverse lay and bound to a 1/2" 30% EHS copperweld messenger by means of a .030" x .375" bare soft copper binding strap, putup 1000 ft. on 84" reels.
Recommended maximum span - 175 ft.
Stringing sag @ 60F - 32"
Ampacity - 285 amperes @ 75C copper temperature and 40C ambient.
O.D. 3.319" x 2.833" @ - - - - - -$3918.00 M ft.

Item 1A 2000 ft. - Ditto above except 336,400 C.M. - 19 strand ECH 26 aluminum conductor, putup 700 ft. on 84" reels.
Recommended maximum span - 200 ft.
Stringing sag @ 60F - 34"
Ampacity - 285 amperes @ 75C conductor temperature and 40C ambient.
O.D. 3.663" x 3.177" @ - - - - -$4185.00 M ft.

Item 1B 6000 ft. - Single Condr. #4/0 - 19 strand bare, semi-conducting tape, .220" natural polyethylene, bedding and shielding tapes, 6/64" RoSeal sheath, putup 2500 ft. on 72" reels @ - -$1150.00 M ft.

Item 1C 6000 ft. - S.C. Ditto Item 1B except 336,400 C.M. - 19 strand ECH 26 aluminum conductor, putup 2500 ft. on 72" reels @ - $1235.00 M ft.

F.O.B. Destination
TERMS: ½ of 1%
SHIPMENT: 7-8 weeks

R.A. Dunn:mab

TERMS: (Standard discount dates apply)
☐ ½ of 1% ☐ 2% Other

Distributor Comm. if any
☐ Net ☐ 5% Other

☐ Competitive Report Requested

Shipment if other than mill condition sheet
F. O. B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

[fol. 6526] **3362**

S. C. Q. D. FILE (Customer)

Request for Quotation

INQUIRY NO. HE 1389

FROM: Boston DISTRICT DATE: December 22, 1958

TO: CENTRAL QUOTATION DEPT., ROME, N.Y.

INQUIRY FROM: Boston Edison Co., Boston, Mass. (Mr. A. Corry) or

FOR SHIPMENT TO: (Mr. Don Gatson)

— THE FOLLOWING MATERIAL —

Please let us have price and delivery – for estimating purposes – on the following:

2,000 ft. 3- Single Condr. #4/0 19 w. copper polyethylene insulation shielded, RoSeal jacket, 15 KV grd. neutral bound to a suitable messenger (advise size) self-supporting cable to be installed on longest spans recommended

Give Sag & recommended Span, O.D. and Ampacity

Alternate:
2,000 ft. 3-Single Condr. #336400 Aluminum

Alternate B
6,000 ft. Single Condr. #4/0 copper polyethylene insulation, shielded, RoSeal jacket, 15 KV grd. neutral – for spinning – as an aerial cable

Alternate C
6,000 ft. Single Condr. #336400 CM Aluminum polyethylene insulation shielded, RoSeal jacket, 15 KV grd. neutral for spinning as aerial cable

TERMS: (Standard discount dates apply) Distributor Comm. if any
☐ ½ of 1% ☐ 2% Other ________ ☐ Net ☐ 5% Other ________ ☐ Competitive Report Requested
Shipment if other than mill condition sheet ________
F. O. B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

3363

[fol. 6527] (SALES DEPT. COPY)

Engineering Department
Recommendations for Quoting

Number: 5319
Inquiry No.: UE – 1393
Date: 12/20/57

Customer: Rochester Edison Co.
Ultimate User:
Spec. or Correspondence Reference:

RECOMMENDED CONSTRUCTION DETAILS

ITEM I
2000' 3/c + 4/0 AWG Type III Polyethylene Rodeal Preassembled Aerial Cable, 15 kv

3/c each: 4/0 AWG
1956 – bare
S.C. tape
.220" HMW Polyethylene
Std bedding and shielding tapes
5/64" Rodeal sheath
Test

3/c twisted, reverse lay, and bound to 1/2" 30% EHS Copperweld messenger by means of .030 x .375" bare soft copper binding strap.
Final Test
Put-up: 1000' on 84"R
Recommended maximum span → 175 feet.
Stringing sag @ 60F → 32"
Ampacity → 285 Amperes @ 75C Copper Temp. & 40C Ambient
O.D. → 3.319 x 2.853"

.528
.021
.440
.036
.020
.033
1.077
.188
1.265

1.316
x2.16
2.630
.486
3.316

1211
3
3633
215
3918

3918.00

Item II
2000' ditto except 336,400 CM – 19 Str. H26 Aluminum Conductor
Put-up: 700' on 84"R
Recommended max span → 200 feet
Stringing sag @ 60F → 34"
Ampacity → 285 Ampere @ 75C conductor Temp. & 40C Ambient
O.D. → 3.663 x 3.177"

.666
.020
.460
.032
1.215
.188
1.403

N37
337
1300
3570
215
4185

4185.00

Prepared by:

[fol. 6529] **3364** [SALES DEPT. COPY]

Engineering Department
Recommendations for Quoting

Number__________ __________
Inquiry No.__________ __________
Date__________ __________

Customer__________
Ultimate User__________
Spec. or Correspondence Reference__________

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1 B 5000' — Single Conductor #4/0 AWG Polyethylene Roseal, 15 kv for field spinning.

#4/0 AWG
19 str — Bare
S.C. tape
.330" ins. Polyethylene
Std bedding & shielding tape
6/64" Roseal sheath
Final Test
Pack-up: 2500' on 75" R

.528
.070
.340
.089
1.077
.156
1.233

1211
61
1150

1150.00

Item 1C 5000' — Single Conductor ditto item 1B except 350,000 - 19 str. H26 Aluminum Conductor

Pack-up: 2500' on 70" R

1.405"

1537
237
1300
65
1235

1235-

Prepared by: [signature]

[fol. 6529] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 35

Request for Quotation Pub-Com 242,000*

INQUIRY NO. NY-668-C

FROM: NEW YORK DISTRICT DATE: 12/1/58

TO: CENTRAL QUOTATION DEPT., ROME, N.Y.

INQUIRY FROM: PUBLIC SERVICED ELEC. & GAS CO.

~~FOR SHIPMENT TO~~

— THE FOLLOWING MATERIAL —

SALES TO ENGR.
REVIEWED BY
DATE RETURNED

"Please quote prices not later than December 8 for furnishing on a commitment basis the following spacer-type, primary, self-supporting cable, to be manufactured to either of the following specifications:

We are to supply the Cu messenger per D. Dean 12/12/58

SPECIFICATION NO. 86 - Copper
SPECIFICATION NO. 87 - Aluminum

Stock Code	Size	Required - 1959 Jan.	Feb.	March	Total Feet	
03-1583	#2/0 3/cond. - aluminum	50,000	50,000	50,000	150,000	@ - -$902.00 M
or similar to						
03-1597	#1 3/cond. - Copper					@ - - - $974.00 M
03-1590	397,500 cm 3/cond. Alum.	25,000	20,000	20,000	65,000	@ - -$1690.00 M
or						
03-1599	#4/0 3/cond. - Copper					@ - - - $1650.00 M

Delivery to New Jersey points in Public Service territory.

Please quote estimated lead time in weeks."

December 8, 1958

F.O B. Destination
TERMS: ½ of 1%
SHIPMENT: 4-5 weeks after receipt of order.

We got 10 M 2/0 - 902 - very very Tolerance ...

W.S.WILLIAMS:DSB

You are fully familiar with our spacer as compared to the spacer outlined in their Spec. and I believe we have to point out that our spacer has 3" spacing. This probably has already been done with them.

TERMS: (Standard discount dates apply) ☐ ½ of 1% ☐ 2% Other________
Distributor Comm. if any ☐ Net ☐ 5% Other________
☒ Competitive Report Requested

Shipment if other than mill condition sheet________
F. O. B. Destination unless otherwise noted.

C.A.Brodock:mab

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

[fol. 6530] **3366** (SALES DEPT. COPY)

Engineering Department
Recommendations for Quoting

Number: ~~#475~~ 8155 [illegible]
Inquiry No.
Date: 12-3-58

Customer: Pub Service Elec + Gas
Ultimate User:
Spec. or Correspondence Reference: Spec #86

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1

No. Cond.	Size + Str.	Rubber [illegible]	P.P. Jkt.	Nom O.D.	Messenger Size + Type	Spacers 1000	[illegible] (per 1000)		
							[illegible] Cond [illegible]	Messenger [illegible]	[illegible]
3	#1 19/w Cu tin MHD	5/64"	3/64	.60"	3/8" 40% HS	35	10	25	105

NOTE This is not listed in Pub Service Spec #86 but this is our recommended construction using #86 as a guide.

Assume same details as on EDR 8455.

Prepared by: [illegible]

[fol. 6531]

#1-12 [illegible]

[illegible] 186.32 AP 891 - 55%

2/10-19 alum - 5-3 [illegible]

160.78 955

140
114
254 901
244
3)677
228 % = 40% over cost = 831 [illegible]
880 30% [illegible] cost 871 [illegible]

4/12-19 Cap. 5-3

AW 366.85 AP 381 60%

397500 alum - 37-5-3 [illegible]

32779 2055 1744.50

1660

1744.00
274
3)1470
490 % 50% over cost - 1744 [illegible]
40% [illegible]
1660 30% [illegible] cost

2/10-19 alum - 5-3 [illegible]

221.38 1305 [illegible]
240
3)1054
385

[fol. 6532]

3368

		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
150,000	1-14 [illegible] 5/64	240	720	114	[illegible]	[illegible]
						967
	3-16 [illegible] pieces ditto	209	637	114	110	981
					974	984
[illegible]	4/0-14 [illegible] Copper ditto	454	1562	114	160	1636
					1648	1650
	397,500 pieces ditto	462	1384	114	160	1620
					1690	1704
						1714

[illegible]

	PCC	K+W
1st [illegible]	974	967
2nd [illegible]	904	984
4th [illegible]	1650	1648
397,500 [illegible]	1690	1704

[fol. 6[illegible]3]

T1 R NY 12/9/58 PM GG

W S WILLIAMS

REF PUB SERV NY 663- C OUR SPACER HAS 6" SPACING NOT 3" AS I SAY IN QUOTE- ASSUME YOU CAUGHT THIS-

BRODOCK

December 5, 1958

Public Service Electric & Gas Co.
80 Park Place
Newark 1, New Jersey

Attention: Mr. J. J. Coleman, Buyer

Gentlemen:

In response to your form letter inquiry dated November 23th re. spacer-type, primary, self-supporting cable, we are pleased to quote as follows:

Specification No. 86- Copper
Specification No. 87 - Aluminum

Stock Code	Size	Required - 1959 Jan.	Feb.	March	Total Feet	Net Price M'
03-1533	#2/0 3/cond. - Aluminum					
or similar to		50,000	50,000	50,000	150,000	$ 902.00
03-1537	#1 3/cond. - Copper					$ 974.00
03-1530	397,500cm 3/cond. Aluminum					$1690.00
OR		25,000	20,000	20,000	65,000	
03-1539	#4/0 3/cond - Copper					$1650.00

Delivery: F.O.B. Destination
Terms: ½ of 1% 10 days, net 30
Shipment: Approx. 4-6 weeks after receipt of order at our plant.

The terms and conditions appearing on the reverse side are to be considered a part of this quotation.

Prices stated herein shall be subject to adjustment to the Company's prices in effect on date of shipment. However, such prices shall not exceed any lawful ceiling prices established and in effect at the time of shipment.

Very truly yours,
ROME CABLE CORPORATION

WSW:DSB

W. S. Williams

[fol. 6535]

(SALES DEPT. COPY)

3371

Engineering Department
Recommendations for Quoting

Number 8455

Inquiry No.

Date 11-13-58

Customer Public Service of Elec & Gas

Ultimate User

Spec. or Correspondence Reference Spec. #86 & 87

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1 JIM: Might be a good idea to have a composite EDR on Public Service Elec & Gas Company's Spacer Requirements. Spec #86 Covers Copper & Spec #87 covers Alum. On both these specs quotation 6" spacing between condr. centers [illegible] rather than 3-3½ as specified.

*Cont

Spec #86 - 5KV rated Spacer Cable MHD Copper

No. of Condrs	Size & Strand	Rozone "A" Insul.	Rop. Jkt	Nom O.D.	Messenger Size & Type	Spacers per 1000'	Grommets to fit: Clevis Pin 5/8"	Grommets to fit: Messenger	Grommets to fit: Phase Condrs
3	#4 7/.0772 tin	5/64"	3/64"	.50"	3/8" 40% HS Cu	35	10	25	105
3	#2/0 19/.0837 "	5/64	3/64	.69"	3/8" 40% HS Cu	35	10	25	105
3 (F)	#4/0 19/.1055 "	5/64	3/64	.80"	7/16" 30% HS Cu	35	10	25	105
3	350MCM 37/.0973 "	5/64	3/64	.95"	7/16" 30% EHS Cu	35	10	25	105
Spec #87 Alum	5KV rated Spacer Cable HD Alum								
3	#2 7/.0974	5/64	3/64	.56"	3/8" 40% HS Cu	35	10	25	105
PS-3783 3 *	#2/0 19/.0837	5/64	3/64	.69"	3/8" 40% HS Cu	35	10	25	105
PS-3779 3	#4/0 19/.1055	5/64	3/64	.80"	3/8" 40% HS Cu	35	10	25	105
PS-3784 3 *	397.5MCM 37/str.	5/64	3/64	1.00"	7/16" 30% HS Cu	35	10	25	105

per 1000'

Marker: Mfgr's year of mfg. shall be permanently identified

PUT-UP: 3 - 1000' lengths parallel on one reel
1 - 1000' - messenger on another reel

NOTE: 1) Neoprene shall adhere to insul.
2) Insul shall be free stripping

Prepared by: R. A. Marker

[fol. 6536] 3372

Copy.

3 - 7 15 000 ft. quantities each

S/c 3/9 19/2th Ech 19 alum 5/64 Rzone A
3/64 Rapraue

S/c 397520 3/4th Ech 19 alum 5/64 Rzone A
3/64 Rapraue

Put up 3x1000 parallel on reel

[fol. 6537] IN UNITED STATES DISTRICT COURT

3373

DEFENDANTS' EXHIBIT 38

Rob Vicr *

Request for Quotation 60,000

INQUIRY NO. NY-807-C

FROM: NEW YORK DISTRICT DATE: 12/1/58

TO: CENTRAL QUOTATION DEPT., ROME, N.Y.

INQUIRY FROM: PUBLIC SERVICE ELEC. & GAS CO.

FOR SHIPMENT TO:

—THE FOLLOWING MATERIAL—

"Please quote prices not later than December 8 for furnishing on a commitment basis the following reverse lay, SEV Self-Supporting Cable, to be manufactured to either of the following specifications:

Specification No. 32-4 - Copper
Specification No. 14-8 - Aluminum

Stock Code	Size	Quantity - Feet	
03-1830	#4/0 3/cond. - copper		$3010.00 M ft.
or		20,000	
03-1860	397.5 MCM 3/cond. - aluminum		$3755.00 M ft.

Delivery to New Jersey points in Public Service territory.

Required: 10,000 ft. each month January & February '59

Please quote estimated lead time in weeks."

December 2, 1958

F.O.B. Destination
TERMS: ½ of 1%
SHIPMENT: 7 weeks lead time

V.S.WILLIAMS:DGB

R.A. Dunn:mab

TERMS: (Standard discount dates apply)
☒ ½ of 1% ☐ 2% Other______
Shipment if other than mill condition sheet______
F. O. B. Destination unless otherwise noted.

Distributor Comm. if any
☐ Net ☐ 5% Other______

☐ Competitive Report Requested

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable.

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

[fol. 6538] **3374** December 8, 19[illegible]

Public Service Elec. & Gas Company
80 Park Place
Newark 1, New Jersey

Attention: Mr. J. J. Coleman

Gentlemen:

In response to your form letter inquiry dated November 26th, we are pleased to quote on 5KV Self-Supporting Cable per Spec. 22-4 - Copper and Spec. 14-2 - Aluminum, as follows:

Stock Code	Size	Quantity - Feet	Price M' Net
03-1530	#4/0 - 3/cond. - copper		$3010.00
OR		20,000	
03-1560	397.5 MCM 3/cond.-Alum.		$3755.00

Delivery: F.O.B. Destination
Terms: ½ of 1% 10 days, net 30
Shipment: Approx. 7 weeks lead time required.

The terms and conditions appearing on the reverse side are to be considered a part of this quotation.

Prices stated herein shall be subject to adjustment to the Company's prices in effect on date of shipment. However, such prices shall not exceed any lawful ceiling prices established and in effect at the time of shipment.

Very truly yours,

ROME CABLE CORPORATION

WSW:DSB

W. S. Williams

3375

[fol. 6539] In United States District Court
Defendants' Exhibit 37

Request for Quotation

INQUIRY NO. NY-GGG-C

FROM: NEW YORK DISTRICT

DATE: 11/28/58

TO: CENTRAL QUOTATION DEPT., ROME, N.Y.

INQUIRY FROM: PUBLIC SERVICE ELEC. & GAS COMPANY

FOR SHIPMENT TO:

— THE FOLLOWING MATERIAL —

"Please quote prices not later than December 2 for furnishing on a commitment basis the following secondary self-supporting cable, to be manufactured to either of the following specifications:

Specification No. 84-1 - Copper
Specification No. 85-1 - Aluminum

	Stock Code	Description	Quantity - Feet	
1086-	03-1808	#1 3/cond. - Copper		@ - $1086.00 M'
	OR		30,000	
1204-	03-1739	#2/0 " - Aluminum		@ - $1204.00 M'
502-	03-1712	#2/0 2/cond. - Copper	650	@ - $ 502.00 M'
	OR		15,000	
792-	03-1733	#4/0 " - Aluminum		@ - $ 792.00 M ft.

Delivery: to New Jersey points in Public Service Territory.

Required: Item 1 or 2 - 10,000 ft. each mouth starting Jan., '59
Item 3 or 4 - 5,000 ft. " " " " "

Please quote estimated lead time in weeks."

F.O.B. Destination
TERMS: ½ of 1%
SHIPMENT: 7 weeks lead time.

December 1, 1958

R.A. Dunn:mab

W.S.WILLIAMS:DCB

TERMS: (Standard discount dates apply)
☐ ½ of 1% ☐ 2% Other______
Shipment if other than mill condition sheet______
F.O.B. Destination unless otherwise noted.

Distributor Comm. if any
☐ Net ☐ 5% Other______

☐ Competitive Report Requested

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

1207
121
1086

1635
163
1465
-258 ALUM
1204

[fol. 6540] **3376** (SALES DEPT. COPY)

Number 300.
Inquiry No. NY- 665-C
Date 11/26/58.

Engineering Department
Recommendations for Quoting

Customer: Public Service Elec + Gas Company —
Ultimate User:
Spec. or Correspondence Reference: Spec-84-1 Copper, Spec 85-1 Alum.

RECOMMENDED CONSTRUCTION DETAILS

ITEM 1 30,000 FT — 3/C-#1 AWG - Copper - Preassembled Aerial Power Cable — STK Code-03-1808

3/c each — #1 AWG - 37/str - Tin - copper
4/64" Performance Insulation (2361)
2/64" Neoprene Sheath (6065)
Ridge Identification -
— O.D. .571"

Assembly — 3/c-#1 AWG Twisted with reverse lay and bound to a 4 D - EHS - 30% Cond. - Copperweld messenger with an .040 x .375 soft copper binder strap. -

O.D. 1.24" x 1.59"

P.U. — 1000 FT (± 100') on 48" Reel.

.333
.175
.063
.571
.006
.010
.537
4.16
34.22
537
107"
1.15974
.080
1.23974

1.160
.348
.080
1.588

Item 2 — 30,000 FT — 3/C-#2/0 AWG Alum - Preassembled Aerial Power Cable — STK Code-03-1779

3/c each #2/0 AWG - 37/.060 - ECH 26 Alum. (3/4 Hd)
4/64" Performance Insulation (236?)
2/64" Neoprene Sheath (6065) - Ridge Ident.

Assembly — 3/c-#2/0 AWG. Twisted with reverse lay and bound to a 4 D - EHS - 30% Cond. Copperweld messenger with an .040 x .375 soft Bare copper Binder strap -

O.D. 1.43" x 1.78"

P.U. — 1000 FT (± 100 FT) on 54" Reel. 58.8

.440
.145
.063
.608
.006
.010
.624
2.16
3744
624
745
.34784
.080
1.428

1.348
.348
.050
1.776

Prepared by: [signature]

[fol. 6557] 3393

COPY

Orig. rec. - 1/27/58
Ret. to cust. - 2/5/58

C-197 - 1/24/58
T.L.Harrigan

Due: 2/3/58

65,000 ft. 3 x 4/0 AWG copper or rubber neoprene 5KV self-supporting Aerial Cable No. 573-2 — $2350.00/M' Net

65,000 ft. 3 x 300MCM aluminum or rubber-neoprene ditto - Cable No. 253A-2 — $2510.00/M' Net

On 1000 ft. reels - state flange diameter and max. outside width of reels you would furnish.

State max. lgths. you can furnish on reels that do not exceed the following dimensions. What are the dimensions of the reels you would use.

1.	Flange Dia.	96"	Max. Outside Wedth	50"
2.	" "	84"	" " "	48"
3.	" "	72"	" " "	65"

The cable is to be furnished per our Spec. No. EO-11-1, App. "C" dated 10/14/57 except insulated condrs. shall be cabled together with reverse lay.

State price of copper & alum & pulling eye.

Delivery required 2Q58

Prices stated herein shall be subject to adjustment to the Company's prices in effect on date of shipment. However, such prices shall not exceed any lawful ceiling prices established and in effect at the time of shipment.

As Req'd

Rome, New York

Destination

1/2 of 1% 10 2/3/58 38-20008

DEFENDANTS' EXHIBIT 40

2. C. Q. D. FILE (Customer)

Request for Quotation

B00300

INQUIRY NO. NY-379-C

FROM: New York Office DISTRICT DATE: Feb. 21, 1958

TO: CENTRAL QUOTATION DEPT., ROME, N. Y.

INQUIRY FROM: Long Island LightingCo.

FOR SHIPMENT TO: Hicksville, L.I., N.Y.

U. S. Dis. COURT
S. D. N. Y.
Ex. No. AB 4021
Gov't ☐ Plf ☐ Def ☒

— THE FOLLOWING MATERIAL —

With reference to the attached, please quote as follows:

Item 1 - 2 Condrs. each #1/0 - 19 strand bare copper, 3/64" RoPrene, 1/C #1/0 - 7 strand bare copper, neutral, twist two insulated conductors around the bare messenger, approx. 39" lay @ - - -$447.00 M ft.

Item 2 - 2 Condrs. each #4/0 - 19 strand bare copper, 3/64" RoPrene, conductors twisted and bound to a 5/16" copperweld messenger with a soft bare copper binding strap @ - - - - - - - - - - - - $888.00 M ft.

Item 3 - 3 Condrs. each #1/0 - 19 strand bare copper, 3/64" RoPrene, 1/C #1/0 - 7 strand bare copper neutral, twist three insulated conductors around the bare messenger, approx. 39" lay @ - - -$642.00 M ft.

Item 4 - 3 Condrs. each #4/0 - 19 strand bare copper, 3/64" RoPrene twisted and bound to a 5/16" copperweld messenger by means of a soft bare copper binding strap @ - - - - - - - - - - - - $1148.00 M ft.

Item 5 - 2 Condrs. each #3/0 - 19 strand aluminum, 5/64" RoPrene twisted and bound to a 5/16" copperweld messenger by means of a soft bare copper binding strap @ - - - - - - - - - - - - - -$482.00 M ft.

Item 6 - 2 Condrs. each 336,400 C.M. - 19 strand aluminum, 6/64" RoPrene twisted and bound to a 3/8" copperweld messenger by means of a soft bare copper binding strap @ - - - - - - - - - - - $729.00M ft.

Item 7 - 3 Condrs. each #1/0 - 19 strand aluminum, 3/64" RoPrene, 1/C #1/0 6/1 ACSR, twist three insulated conductors around the bare messenger, approx. 39" lay @ - - - - - - - - - - - - - - - $431.00 M ft.

Item 8 - 3 Condr. each 3/0 - 19 strand aluminum, 5/64" RoPrene, conductors twisted and bound to a 5/16" copper weld messenger by means of a soft bare copper binding strap @ - - - - - - - - - - - $701.00 M ft.

TERMS: (Standard discount dates apply)
☐ ½ of 1% ☐ 2% Other

Distributor Comm. if any
☐ Net ☐ 5% Other

☐ Competitive Report Requested

Shipment if other than mill condition sheet
F.O.B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

[fol. 6559] **3395**

2, C. O. D. FILE (Customer)

Request for Quotation

B00301

INQUIRY NO. NY-379-C

FROM: New York Office DISTRICT

DATE: Feb. 21, 1938

TO: CENTRAL QUOTATION DEPT., ROME, N. Y.

INQUIRY FROM: Long Island Lighting Co.

FOR SHIPMENT TO: Hicksville, L.I., N.Y.

— THE FOLLOWING MATERIAL —

-2-

Item 9 - 3 Condrs. each #336,400 C.M. - 19 strand, 6/64" DuPrene, conductors twisted and bound to a 3/8" copperweld messenger by means of a soft bare copper binding strap @ - -$974.00 M ft.

All twisted assemblies have approximately 39" lay.

The above prices are for estimating purposes in quantities of 10,000 ft.

On the items of copper self-supporting the terms are 2% 10th prox. net. 31 st prox. On the items of aluminum self-supporting the terms are net 30 days; and on the items with the copperweld messenger the terms are ½ of 1% new terms.

jww:mab

J.H. Wright

TERMS: (Standard discount dates apply)
☐ ½ of 1% ☐ 2% Other________

Distributor Comm. if any
☐ Net ☐ 5% Other________

☐ Competitive Report Requested

Shipment if other than mill condition sheet________
F.O.B. Destination unless otherwise noted.

District Office Note That All Inquiries Must Contain All Necessary Data Including the Following Details Wherever They Are Applicable:

1. Size and Stranding.
2. Temper.
3. Number of Conductors.
4. Voltage, if other than 600.
5. Type of Insulation.
6. Type of Sheath, Jacket, or Covering.
7. Finish.
8. Lengths and/or Put-up Required.
9. Any Special Specification, Requirement or Application.
10. Delivery Desired.

Defendants' Exhibit 41

ROME CABLE DIVISION OF ALCOA

ROME, NEW YORK

SALES SERVICE CLERK

SALES ORDER

SHIP FROM
ROME, NEW YORK

INVOICE TO
BOSTON EDISON COMPANY
39 BOYLSTON STREET
BOSTON 12, MASS

SHIP TO
BOSTON EDISON COMPANY
200 CALVARY STREET
WALTHAM 54, MASS

DATE ENTERED	CODE NUMBER	ORDER NUMBER
11 23 60	069 09411	1 BO X 35239-C

RENEGOTIATION: NO
SALES OR USE TAX: NONE EXEMPT

TERMS: 1/2 OF 1% 10 DAYS NET 30 DAYS FROM DATE OF INVOICE

F.O.B.: DESTINATION

VIA: TRUCK LATER

GOVT. CONTRACT NO.: 20-017

CUSTOMER P.O. NO.: 39347

PROD. NO. / SHIPMENT ESTIMATED BY WEEK ENDING: MO. 12 WK. 31 YR. 60 — NO — SHIPMENT REQUIRED: SEE NOTE

CUST. NAME ABBREVIATION: BOS EDISON
CONTROL NUMBER:

PACKING: SEE ITEM

Products as follows

ORDER NUMBER: BO X 35239-C (300)

INSPECTION AT SOURCE: ROME ALCOA
PARTIAL SHIPMENTS: YES
QUANTITY TOLERANCE PLUS % MINUS %: STD

ITEM NO.	ITEM DESCRIPTION	PRODUCT CODE	QUANTITY ORDERED PCS., FT., ETC.	POUNDS	PRICE PER POUND OR AS INDICATED
1	NO 2-7 STR S D 3/64 IN ROPRENE W/P PER E2.4-3, 3 REV 12-3-58 MIN 80 LB MAX 120 LB COIL 143-02-23-030Δ	1/3 - 149.00 211.5 F.I.C. 227.61	200,000 FT		$99.00/ M FT 97.00 2919

11/29

U. S. DIS. COURT N. D. N. Y. Ex. No. AR 41 98 Govt Pltf Def

BO 10200

TOTAL ALUM. LBS	CONFER BEFORE PROD	SHIP	CUS. NO.	INVOICE COPIES	NO	SHIPMENT NOTICES
	NO	NO	4	3	0	

CUSTOMER'S USE: 5110-POW R TRANSMISSION

NO. TYPE INSPECTION REPORTS: 0

NOTES
1 SHIP AND INVOICE ON ROME PAPER
2 PRICING POLICY NO 3
3 PRICED PER QUOTATION NOV 14, COPY TO D B DUFFY
4 SHIPMENT REQUIRED 150,000 FT ON 1-2-61, AND 50,000 FT 2-1-61
5 REFER TO J A MC GUINNES PROM WK 12/31 SURE

A VAN VLACK/WGD MSB JH

SF-5005-10M-8-60

DEFENDANTS' EXHIBIT 42

ROME CABLE CORPORATION
ROME, NEW YORK

EXTRA COPIES

CUSTOMER ORDER NO.	DATE	TERRITORY	OUR ORDER NO.	DATE ENTERED	
70090-7-LL	5/11/60	ST-L.	A 5993	5/16/60	1 Pl.

SOLD TO:
DOW CHEMICAL COMPANY
PURCH DEPT. - LOUISIANA DIV.
POST OFFICE BOX 150
PLAQUEMINE, LOUISIANA.

SHIP TO:
DOW CHEMICAL COMPANY
RECEIVING DEPT.
PLANT SITE
PLAQUEMINE, LOUISIANA.

BILL NOTES: Con 650 Furnish 4 copies of certified test reports.

TERMS: NET 30 DAYS.

ROUTING: LATER PPD. Coastal NYC-A&S-MP T&P

F.O.B. POINT: DEST. T&P 74114

Terms are Correct
Disc deducted 7/18

ITEM NO.	QUANTITY ORDERED		DESCRIPTION	EXTENSION	PRICE
1.	45,135 FT.	wk 6/20	265 — 700,000 CM-61 STR. EC-H19 ALUMINUM 6/64" BLK POLYETHYLENE DOW CHEMICAL COMPOUND 305A3 ON 84" REELS AS FOLLOWS: 3 REELS —4575 FT. EACH. 3 REELS —5700 FT. EACH. 3 REELS —4770 FT. EACH. 198-64-41-010	4/30 45,770	$405.00 PER M FT.

SHIPPING NOTES: should be chgd back Uj

BILLING NOTES

POLICY #1.

3397

[fol. 6562] IN UNITED STATES DISTRICT COURT

3398

DEFENDANTS' EXHIBIT 43

UNUSED PRIMARY ALUMINUM CAPACITY

	U.S. Primary Aluminum Capacity			Alcoa Primary Aluminum Capacity		
		Unused			Unused	
Year	Total	Amount	Percent %	Total	Amount	Percent %
1948	1,298,000	51,088	4	650,000	(2,309)	-
1949	1,454,150	247,226	17	588,000	5,217	1
1950	1,710,000	272,756	16	739,500	31,546	4
1951	1,691,500	17,738	1	742,500	(108,580)	(15)
1952	2,283,900	409,240	18	968,500	33,364	3
1953	2,621,400	117,374	4	1,096,000	(126,614)	(12)
1954	2,776,400	(144,730)	(5)	1,141,000	(190,874)	(17)
1955	3,218,400	86,958	3	1,413,000	8,539	1
1956	3,551,000	193,092	5	1,585,000	72,722	5
1957	3,683,500	388,082	11	1,585,000	160,905	10
1958	4,388,500	1,257,386	29	1,596,500	554,776	35
1959	4,805,500	899,150	19	1,596,500	342,915	21
1960	4,937,500	908,506	18	1,706,500	252,530	15

Quantities are thousands of pounds.

Note: The above tabulation shows that Alcoa production exceeded Alcoa capacity in the years 1951, 1953 and 1954. This results from capacity having been based on median water conditions and assumed no purchase of high cost power. High cost power was actually used during the year 1951, and better than median water conditions existed in 1953 and 1954 resulting in Alcoa production exceeding Alcoa capacity. As a result of Alcoa production exceeding Alcoa capacity in 1954, total U.S. production exceeded total U.S. capacity in that year.

Source of Data

UNITED STATES PRIMARY ALUMINUM CAPACITY
U.S. BUREAU OF MINES MINERALS YEARBOOK,
OR "ALUMINUM" PREPRINTS
YEAR 1948-EDITION OF 1948 PREPRINT, TEXT PAGE 3
YEAR 1949-EDITION OF 1951 YEARBOOK, TABLE 3, PAGE 133
YEAR 1950-EDITION OF 1951 YEARBOOK, TABLE 3, PAGE 133
YEAR 1955-EDITION OF 1955 PREPRINT, TEXT PAGE 1
YEAR 1956-EDITION OF 1956 PREPRINT, TABLE 3, PAGE 4
YEAR 1957-EDITION OF 1957 PREPRINT, TABLE 2, PAGE 4
YEAR 1958-EDITION OF 1958 PREPRINT, TABLE 3, PAGE 4
YEAR 1959-EDITION OF 1959 PREPRINT, TABLE 4, PAGE 3

U.S. BUREAU OF MINES, MINERAL INDUSTRY SURVEYS,
MINERAL MARKET REPORT-YEAR 1960-SURVEY NO. 3258,
"ALUMINUM IN 1960" TABLE 4, PAGE 4

AMERICAN BUREAU OF METAL STATISTICS YEARBOOK
YEAR 1951 - PAGE 95
YEAR 1952 - PAGE 96
YEAR 1953 - PAGE 97
YEAR 1954 - PAGE 98

UNUSED UNITED STATES PRIMARY ALUMINUM CAPACITY
CALCULATED USING CAPACITY SHOWN, AND UNITED STATES PRIMARY
ALUMINUM PRODUCTION FROM FOLLOWING SOURCE:
U.S. BUREAU OF MINES MINERALS YEARBOOK ("ALUMINUM" PREPRINTS)
YEARS 1948 & 1949 - EDITION OF 1951, TABLE 1, PAGE 1
YEARS 1950 TO 1954 - EDITION OF 1954, TABLE 1, PAGE 1
YEARS 1955 TO 1959 - EDITION OF 1959, TABLE 1, PAGE 1

U.S. BUREAU OF MINES, MINERAL INDUSTRY SURVEYS, MINERAL MARKET
REPORT-YEAR 1960-SURVEY NO. 3258, "ALUMINUM IN 1960"
TABLE 4, PAGE 4

ALCOA PRIMARY ALUMINUM CAPACITY
AMERICAN METAL MARKET NEWSPAPER, ISSUE DATED 8-29-61

UNUSED ALCOA PRIMARY ALUMINUM CAPACITY
CALCULATED USING CAPACITY SHOWN, AND ALCOA PRIMARY ALUMINUM
PRODUCTION FROM ALUMINUM STOCK REPORTS (COMPANY RECORDS)

Defendants' Exhibit 45

ALUMINUM PIG, INGOT OR BILLET TO BE MADE AVAILABLE TO NON-INTEGRATED USERS UNDER PROVISIONS OF GSA SUPPLY CONTRACTS

	Alcoa		Kaiser		Reynolds		Harvey		Total	
Year	Quantity	Percent of Alcoa 1960 Capacity	Quantity	Percent of Kaiser 1960 Capacity	Quantity	Percent of Reynolds 1960 Capacity	Quantity	Percent of Harvey 1960 Capacity	Quantity (1)	Percent of Total U.S. 1960 Capacity
	#	%	#	%	#	%	#	%	#	%
1959	150,500	8.8	-	-	126,000	9.0	Unknown		276,500	5.6
1960	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1961	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1962	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1963	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1964	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1965	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1966	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1967	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1968	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1969	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1970	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1971	150,500	8.8	175,136	14.4	126,000	9.0	Unknown		451,636	9.1
1972	139,500	8.2	171,286	14.1	126,000	9.0	Unknown		436,786	8.8
1973	112,500	6.6	59,184	4.9	126,000	9.0	Unknown		297,684	6.0

Thousands of Pounds

Source of Data

Alcoa - Amendment dated 12/31/58 to GSA supply contracts nos. GS-00P-(D) - 12007 and - 12096
Kaiser - Amendment dated 8/14/59 to GSA supply contracts nos. GS-00P-(D) - 12006, - 12143, - 12192 and - 12213
Reynolds - Letter agreement dated 9/16/57 amending GSA supply contracts nos. GS-00P-(D) - 12008, - 12202 and - 12214
Percentages based on capacity given in U.S. Bureau of Mines Mineral Industry Surveys, Mineral Market Report Year 1960 - Survey No. 3258, "Aluminum in 1960", table 4, page 4

(1) Excludes Harvey for which we do not have information.

[fol. 6564]

IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 47

Primary Aluminum Purchased by Rome

Year	Total Primary Aluminum Sales to Non-Integrated Fabricators by U.S. Primary Producers	Alcoa Primary Aluminum Sales to Non-Integrated Fabricators	Rome Primary Aluminum Purchases	Rome Primary Aluminum Purchases: % of Total Sales to Non-Integrated Fabricators	Rome Primary Aluminum Purchases: % of Alcoa Sales to Non-Integrated Fabricators
1954	$ 85,324	$27,227	$ 327	.4	1.2
1955	177,394	71,531	692	.4	1.0
1956	177,656(1)	91,549	1,277	.7	1.4
1957		58,633	836		1.4
1958		46,038	785		1.7

Thousands of Dollars

(1) First 9 months

Source of Data

Total Primary Aluminum Sales to Non-Integrated Fabricators by U.S. Primary Producers
United States v. Aluminum Company of America, 153 F. Supp. 132, 173 (S.D.N.Y. 1957).

Alcoa Primary Aluminum Sales to Non-Integrated Fabricators
Compiled from Analysis of Shipments and Transfers and Record of Shipments to Customers (company records)

Rome Primary Aluminum Purchases
Raw Materials Receipts Records (company records)

[fol. 6565]

In United States District Court

Defendants' Exhibit 48

Primary Aluminum Purchased by Rome

Year	Total Primary Aluminum Sales to Non-Integrated Fabricators by U.S. Primary Producers	Alcoa Primary Aluminum Sales to Non-Integrated Fabricators	Rome Primary Aluminum Purchases	Rome Primary Aluminum Purchases: % of Total Sales to Non-Integrated Fabricators	Rome Primary Aluminum Purchases: % of Alcoa Sales to Non-Integrated Fabricators
1954	386,767 #	115,082 #	1,611 #	.4	1.4
1955	751,742	294,723	3,175	.4	1.1
1956	704,206(1)	348,386	5,258	.7	1.5
1957		209,119	3,236		1 5
1958		175,499	3,133		1.8

Thousands of Pounds

(1) First 9 months

Source of Data

Total Primary Aluminum Sales to Non-Integrated Fabricators by U.S. Primary Producers
United States v. Aluminum Company of America, 153 F. Supp. 132, 173 (S.D.N.Y, 1957)

Alcoa Primary Aluminum Sales to Non-Integrated Fabricators
Compiled from Analysis of Shipments and Transfers and Record of Shipments to Customers (company records)

Rome Primary Aluminum Purchases
Raw Materials Receipts Records (company records)

[fol. 6566] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 49

Primary Aluminum Purchased by Rome

Year	Total U.S. Primary Aluminum Production	Alcoa Primary Aluminum Production	Rome Primary Aluminum Purchases	Rome Primary Aluminum Purchases % of Total U.S. Primary Aluminum Production	Rome Primary Aluminum Purchases % of Alcoa Primary Aluminum Production
1954	2,921,130#	1,331,874#	1,611#	.1	.1
1955	3,131,442	1,404,461	3,175	.1	.2
1956	3,357,908	1,512,278	5,258	.2	.3
1957	3,295,418	1,424,095	3,236	.1	.2
1958	3,131,114	1,041,724	3,133	.1	.3

#Thousands of Pounds

Source of Data

United States Primary Aluminum Production
U.S. Bureau of Mines Minerals Yearbook ("Aluminum" Preprints)
Year 1954—Edition of 1954, table 1, page 1
Years 1955 to 1958—Edition of 1959, table 1, page 1

Alcoa Primary Aluminum Production
Compiled from Aluminum Stock Reports (company records)

Rome Primary Aluminum Purchases
Raw Materials Receipts Records (company records)

[fol. 6567] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 50

Copper and Aluminum Purchased by Rome (1)

Year	Copper	Aluminum	Total	Percent Copper
1954(2)............	$16,850	$ 401	$17,251	97.7
1955(2)............	24,549	659	25,208	97.4
1956(2)............	27,067	1,258	28,325	95.6
1957(2)............	15,709	790	16,499	95.2
1958............	12,152	813	12,965	93.7
1959 (1st Qtr.)......	3,942	239	4,181	94.3

Thousands of Dollars.

(1) Rome plant only.

(2) Net after deducting value of scrap generated.

Source of Data:
Raw Material Receipts Records (company records).

[fol. 6568] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 51

Copper and Aluminum Purchased By Rome
Pounds (In Thousands)

Year	Copper	Aluminum	Total	% Copper
1954...............	56,166#	1,980#	58,146	96.6
1955...............	61,561	3,028	64,589	95.3
1956...............	62,462	5,189	67,651	92.3
1957...............	52,580	3,058	55,638	94.5
1958...............	47,519	3,234	50,753	93.6
1959 (1st Quarter)...	13,155	948	14,103	93.3

(1) Rome Plant only.

Source of Data:
Raw Materials Receipt Record (Company records).

[fol. 6569] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 52

Copper and Aluminum Wire and Cable Sold by Rome

Year	Copper Wire & Cable	Aluminum Wire & Cable	Total	Percent Copper
1954	$27,142	$ 1,770	$28,912	93.9
1955	36,921	2,458	39,379	93.8
1956	39,119	3,646	42,765	91.5
1957	26,992	2,888	29,880	90.3
1958	21,261	2,191	23,452	90.7
1959 (1st Qtr.)	5,891	509	6,400	92.0

Thousands of Dollars.

Source of Data:
Product Sales Records (company records).

[fol. 6570] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 53

Aluminum Wire and Cable Overlap Products Sold by Rome

Year	Overlap Wire and Cable	Total Wire and Cable	Percent Overlap
1954	$1,716	$28,912	5.9
1955	2,302	39,379	5.8
1956	3,396	42,765	7.9
1957	2,317	29,880	7.8
1958	1,989	23,452	8.5
1959 (1st Qtr.)	403	6,400	6.3

Thousands of Dollars.

Source of Data:
Product Sales Records (company records).

[fol. 6571] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 54

Rome Sales of Weatherproof
(1956–1960) (Thousands of Dollars)

Year	Total Value	Aluminum Value	Aluminum %	Copper Value	Copper %
1956	4,430	1,031	23.3	3,399	76.7
1957	3,153	579	18.4	2,574	81.6
1958	2,221	482	21.8	1,739	78.2
1959	2,235	332	14.9	1,903	85.1
1960	1,971	245	12.5	1,726	87.5

Source: Table I (page 8) of Defendants' Answers to Plaintiff's Interrogatories.

[fol. 6572] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 55

Rome Sales of Service Drop Cable
(1956–1960) (Thousands of Dollars)

Year	Total Value	Aluminum Value	Aluminum %	Copper Value	Copper %
1956	2,636	2,085	79.1	551	20.9
1957	1,850	1,492	80.7	358	19.3
1958	1,528	1,250	81.8	278	18.2
1959	1,643	1,327	80.8	316	19.2
1960	1,567	1,312	83.7	255	16.3

Source: Table I (page 9) of Defendants' Answers to Plaintiff's Interrogatories.

[fol. 6573] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 56

Rome Sales of Service Drop and Weatherproof
(1956–1960) (Thousands of Dollars)

Year	Total Value	Aluminum Value	Aluminum %	Copper Value	Copper %
1956	7,066	3,116	44.1	3,950	55.9
1957	5,003	2,071	41.4	2,932	58.6
1958	3,749	1,732	46.2	2,017	53.8
1959	3,878	1,659	42.8	2,219	57.2
1960	3,538	1,557	44.1	1,981	55.9

Source: Table I (pages 8–9) of Defendants' Answers to Plaintiff's Interrogatories.

[fol. 6574] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 57

CHANGES IN BASE PRICE OF PRIMARY ALUMINUM(4), E.C. REDRAW ROD AND SELECTED CABLE SIZES FROM JULY 22, 1946 TO DATE AND COMPARISON OF SPREAD BETWEEN THESE PRODUCTS DURING SAME PERIOD

	Base Price Per Aluminum Pound									Spread in Base Price		
			Cable									
Date of Price Change(2)	Primary Aluminum(4) $	E.C. H12 & H14 Redraw Rod $	1/0 6/1 ACSR $	4 7/1 ACSR $	795,000 26/7 ACSR $	900,000 54/7 ACSR $	336,400 19 All Alum. $	795,000 37 All Alum. $	Arithmetic Average $	Pig to Redraw Rod $	Redraw Rod To Cable(3) $	Pig To Cable $
7/22/46	.140	.185	.290(1)	.327(1)	.288(1)	.281(1)	.265(1)	.261(1)	.285(1)	.045	.100	.145
12/10/46	.140	.190	.295(1)	.352(1)	.299(1)	.294(1)	.265(1)	.242(1)	.291(1)	.050	.101	.151
7/25/47	.140	.194	.310(1)	.373(1)	.315(1)	.307(1)	.271(1)	.247(1)	.304(1)	.054	.110	.164
6/28/48	.150	.210	.329(1)	.394(1)	.334(1)	.325(1)	.291(1)	.266(1)	.323(1)	.060	.113	.173
10/11/48	.160	.225	.346(1)	.414(1)	.351(1)	.342(1)	.306(1)	.281(1)	.340(1)	.065	.115	.180
1/27/50		.220	.345	.414	.350	.340	.303	.277	.338	.060	.118	.178
5/22/50	.165									.055	.118	.173
10/4/50	.180	.240	.369	.439	.374	.365	.316	.301	.361	.060	.121	.181
8/4/52	.190	.252	.387	.461	.393	.383	.332	.317	.379	.062	.127	.189
1/23/53	.195	.262	.400	.476	.406	.396	.345	.329	.392	.067	.130	.197
7/27/53	.200		.411	.493	.410	.400	.345	.330	.398	.062	.136	.198
3/8/54			.402	.484	.401	.392	.342	.327	.391	.062	.129	.191
8/9/54	.205	.270	.420	.506	.418	.410	.357	.342	.409	.065	.139	.204
1/13/55	.215	.280	.430	.516	.429	.419	.367	.352	.419	.065	.139	.204
8/11/55	.225	.295	.461	.551	.459	.448	.390	.375	.447	.070	.152	.222
2/28/56	.230	.305	.476	.566	.474	.463	.405	.390	.462	.075	.157	.232
3/29/56	.245	.320	.490	.582	.489	.478	.420	.405	.477	.075	.157	.232
8/10/56	.255	.333	.520	.618	.516	.505	.442	.426	.505	.078	.172	.250
2/8/57	.255	.333	.515	.611	.513	.502	.441	.425	.501	.078	.168	.246
8/1/57	.265	.346	.539	.642	.536	.524	.451	.425	.520	.081	.174	.255
10/7/57			.495	.591	.493	.483	.411	.385	.476	.081	.130	.211
4/1/58	.245	.326								.081	.150	.231
8/1/58	.252	.333								.081	.143	.224
11/25/58			.476	.568	.474	.466	.398	.372	.459	.081	.126	.207
1/13/59			.436	.522	.434	.429	.371	.345	.423	.081	.090	.171
4/27/59			.434	.519	.432	.427	.369	.344	.421	.081	.086	.159
5/11/59			.430	.514	.428	.422	.366	.340	.417	.081	.084	.165
11/2/59			.445	.531	.438	.432	.373	.347	.423	.081	.095	.176
12/17/59	.265	.348	.465	.551	.458	.452	.393	.367	.448	.083	.100	.183
8/1/60		.350	.475	.561	.468	.462	.403	.377	.455	.085	.108	.193
12/14/60			.475	.561	.448	.442	.403	.361	.443	.085	.098	.183
4/12/61		.307								.042	.141	.183
6/9/61			.498	.581	.485	.468	.408	.382	.470	.042	.163	.205
9/28/61	.245	.297	.494	.576	.480	.463	.403	.377	.466	.052	.169	.221
10/23/61		.280								.035	.186	.221

(1) Prior to 1/27/50 there was no transportation allowance on cable, therefore, $.0135 per composite pound has been added to the price schedule indicated to adjust for the present full transportation allowance basis.

(2) These are the exact dates of the cable price changes. In some cases the pig and redraw price changes vary from these dates by a few days.

(3) The spread between redraw and cable is based on the difference between the redraw price and the arithmetic average of the cable prices shown above.

(4) 7-22-46 to 2-27-56 - 99% Minimum Average Pig
2-28-56 to 7-31-60 - E.C. Alloy Pig
8-1-60 to date - E.C. Alloy Ingot

Source of Data - Above prices taken or calculated from yellow price data sheets.

[fol. 6575] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 58

Alcoa

Electrical Conductor Business Reported Lost to All Competitors
April 1957 Through March 1959

Competitor	Aluminum Weight
Anaconda Co.	11,027,225#
Central Cable Corp.	456,074
Essex Wire Co.	1,010,150
General Cable Corp.	1,270,630
General Electric Co.	138,536
Kaiser Aluminum & Chemical Corp.	22,566,850
Midland	178,602
Nehring Electrical Works	1,627,667
Paranite Wire and Cable	3,131,695
Reynolds Metals Co.	18,364,188
Rome Cable	22,455
Southern Electrical Corp.	2,541,201
Southwire Co.	3,246,504
Texas Wire	17,700
Unknown	11,768,243
Total	78,267,721

Total Lost to Rome Cable

Known (see above)	22,455
Portion of "Unknown" (see above)	17,059
Total	39,514
Rome's Percentage of Total Lost Business	.05%

Source of Data.

Summaries of Alcoa's Potential Business Reports and Rome's Sales Orders (company records).

[fol. 6576]

In United States District Court

Defendants' Exhibit 59

Shipments of ACSR and Aluminum Cable, Bare
By Primary Producers or Affiliates (Including Merged Companies) and Other Producers (1954–1961)(1)
(Thousands of Pounds)

Year	Total(2)	Primary Producers or Affiliates(3)		Other Producers(4)		Alcoa(5)		Rome(5)	
			%		%		%		%
1954	147,166	129,692	88.1	17,474	11.9	71,215	48.4	241	0.2
1955	157,237	139,159	88.5	18,078	11.5	67,850	43.2	224	0.1
1956	188,282	152,905	81.2	35,377	18.8	56,161	29.8	603	0.3
1957	181,701	148,888	81.9	32,813	18.1	58,964	32.3	535	0.3
1958	175,157	151,668	86.6	23,489	13.4	56,990	32.5	537	0.3
1959	197,065	165,007	83.7	32,058	16.3	61,934	31.4	1,342	0.7
1960	184,402	154,443	83.8	29,959	16.2	56,399	30.6	255	0.1
1961	234,265	203,133	86.7	31,132	13.3	61,106	26.1	37	...

Sources:

(1) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U. S. Rubber Co.

(2) U.S. Department of Commerce, BDSA, Aluminum & Magnesium Division, reports entitled, "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers" for the period in question.

(3) Same as (2), except that "Integrated Producers" volume is increased by addition of volumes of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production.

(4) Same as (2), except that "Nonintegrated Producers" volume is reduced by subtraction of volumes of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production.

(5) Shipments reported by both Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

[fol. 6577]

In United States District Court

Defendants' Exhibit 60

Shipments of Aluminum Insulated or Covered Wire and Cable
By Primary Producers or Affiliates (Including Merged Companies) and Other Producers (1954–1961)(¹)
(Thousands of Pounds)

Year	Total(²)	Primary Producers or Affiliates(²)	%	Other Producers(²)	%	Alcoa(³)	%	Rome(³)	%
1954	25,009	17,059	68.2	7,950	31.8	2,513	10.0	1,718	6.9
1955	40,091	29,190	72.8	10,901	27.2	4,349	10.8	2,782	6.9
1956	57,588	36,024	62.5	21,564	37.5	4,919	8.5	3,596	6.2
1957	50,753	32,287	63.6	18,466	36.4	4,778	9.4	2,707	5.3
1958	51,346	36,056	70.2	15,290	29.8	5,970	11.6	2,411	4.7
1959	61,153	41,641	68.1	19,512	31.9	7,461	12.2	2,680	4.4
1960	64,215	43,197	67.3	21,018	32.7	6,800	10.6	2,736	4.2
1961	68,876	45,789	66.5	23,087	33.5	5,058	7.3	3,889	5.7

Sources:

(¹) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U.S. Rubber Co. "Other producers" include captive plants in all years.

(²) U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division report dated November 8, 1961, entitled: "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960." Data for 1961 from current quarterly reports entitled, "Gross Shipments of Aluminum Mill Shapes By Integrated and Nonintegrated Producers."

(³) Shipments reported by Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

[fol. 6578]

In United States District Court

Defendants' Exhibit 61

Shipments of Aluminum Conductor Wire and Cable
By Primary Producers or Affiliates (Including Merged Companies) and Other Producers (1954–1961)(1)
(Thousands of Pounds)

Year	Total(2)	Primary Producers or Affiliates(3)	%	Other Producers(4)	%	Alcoa(5)	%	Rome(5)	%
1954	172,175	146,751	85.2	25,424	14.8	73,728	42.8	1,959	1.1
1955	197,328	168,349	85.3	28,979	14.7	72,199	36.6	3,006	1.5
1956	245,870	188,929	76.8	56,941	23.2	61,080	24.8	4,199	1.7
1957	232,454	181,175	77.9	51,279	22.1	63,742	27.4	3,242	1.4
1958	226,503	187,724	82.9	38,779	17.1	62,960	27.8	2,948	1.3
1959	258,218	206,648	80.0	51,570	20.0	69,395	26.9	4,022	1.5
1960	248,617	197,640	79.5	50,977	20.5	63,199	25.4	2,991	1.2
1961	303,141	248,922	82.1	54,219	17.9	71,164	23.5	3,926	1.3

Sources:

(1) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U.S. Rubber Co. "Other producers" include captive plants in all years.

(2) The sum of "Insulated or Covered Wire and Cable" and "ACSR and Bare Cable" items from the U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division reports entitled "Gross Shipments of Aluminum Mill Shapes by Integrated and Nonintegrated Producers" for the period in question.

(3) The sum of the following:

(a) "Integrated Producers" shipments taken from reports in note (2) above, increased by addition of shipments of merged companies for years prior to merger, obtained fron documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production; and

(b) "Primary Producers or Affiliates" shipments of "Insulated or Covered Wire and Cable" reported in the U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division report dated November 8, 1961, entitled "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960."

(4) The sum of the following:

(a) "Nonintegrated Producers" shipments, taken from reports in note (2) above, decreased by subtracting shipments of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production; and

(b) "Other Producers" shipments of "Insulated or Covered Wire and Cable" reported in the U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division report dated November 8, 1961, entitled "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960."

(5) Shipments reported by Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

DEFENDANTS' EXHIBIT 62

Post-Acquisition Growth of Non-Integrated Producers of ACSR and Aluminum Cabel, Bare (1958–1961) (1)

Year	Total (2) Thou. Pounds	Total (2) % Change from 1958	Primary Producers or Affiliates (3) Thou. Pounds	Primary Producers or Affiliates (3) %	Primary Producers or Affiliates (3) % Change from 1958	Other Producers (4) Thou. Pounds	Other Producers (4) %	Other Producers (4) % Change from 1958	Alcoa—Rome (5) Thou. Pounds	Alcoa—Rome (5) %	Alcoa—Rome (5) % Change from 1958
1958	175,157	....	151,668	86.6	....	23,489	13.4	....	57,527	32.8	....
1959	197,065	+12.5	165,007	83.7	+ 8.8	32,058	16.3	+36.5	63,276	32.1	+10.0
1960	184,402	+ 5.3	154,443	83.8	+ 1.8	29,959	16.2	+27.5	56,654	30.7	− 1.5
1961	234,265	+33.7	203,133	86.7	+33.9	31.132	13.3	+32.5	66,143	26.1	+15.0

Sources:

(1) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U.S. Rubber Co.

(2) U.S. Department of Commerce, BDSA, Aluminum & Magnesium Division, reports entitled, "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-Integrated Producers" for the period in question.

(3) Same as (2), except that "Integrated Producers" volume is increased by addition of volumes of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production.

(4) Same as (2), except that "Non-Integrated Producers" volume is reduced by subtraction of volumes of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production.

(5) Shipments reported by both Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

[fol. 6580]

In United States District Court

Defendants' Exhibit 63

Post-Acquisition Growth of Non-Integrated Producers of Aluminum Insulated or Covered Wire and Cable (1958–1961) (1)

Year	Total (2) Thou. Pounds	Total (2) % Change from 1958	Primary Producers or Affiliates (2) Thou. Pounds	Primary Producers or Affiliates (2) %	Primary Producers or Affiliates (2) % Change from 1958	Other Producers (2) Thou. Pounds	Other Producers (2) %	Other Producers (2) % Change from 1958	Alcoa—Rome (3) Thou. Pounds	Alcoa—Rome (3) %	Alcoa—Rome (3) % Change from 1958
1958	51,346	....	36,056	70.2	....	15,290	29.8	....	8,381	16.3	....
1959	61,153	+19.0	41,641	68.1	+15.4	19,512	31.9	+27.6	10,141	16.6	+20.9
1960	64,215	+25.0	43,197	67.3	+19.8	21,018	32.7	+37.5	9,536	14.8	+13.8
1961	68,876	+34.1	45,789	66.5	+27.0	23,087	33.5	+51.0	8,947	13.0	+ 6.7

Sources:

(1) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U.S. Rubber Co. "Other producers" include captive plants in all years.

(2) U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division report dated November 8, 1961, entitled, "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960." Data for 1961 from current quarterly reports entitled, "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-Integrated Producers."

(3) Shipments reported by Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

[fol. 6581]

[fol. 6581]

In United States District Court

Defendants' Exhibit 64

Post-Acquisition Growth of Non-Integrated Producers of Aluminum Conductor Wire and Cable (1958–1961) (1)

Year	Total (2)		Primary Producers or Affiliates (3)			Other Producers (4)			Alcoa—Rome (5)		
	Thou. Pounds	% Change from 1958	Thou. Pounds	%	% Change from 1958	Thou. Pounds	%	% Change from 1958	Thou. Pounds	%	% Change from 1958
1958	226,503	....	187,724	82.9	....	38,779	17.1	....	65,908	29.1	....
1959	258,218	+14.0	206,648	80.0	+10.1	51,570	20.0	+33.0	73,417	28.4	+11.4
1960	248,617	+ 9.8	197,640	79.5	+ 5.3	50,977	20.5	+31.5	66,190	26.6	+ 0.4
1961	303,141	+33.8	248,922	82.1	+32.6	54,219	17.9	+39.8	75,090	24.8	+13.9

Sources:

(1) Primary producers or affiliates included, for all years 1954–1960, are Aluminum Company of America, Anaconda Wire & Cable Co., Kaiser Aluminum and Chemical Corp., Olin Mathieson Chemical Corp., and Reynolds Metals Co., and the merged companies included for years prior to merger are Rome Cable Corp., Southern Electrical Corp., and U.S. Rubber Co. "Other producers" include captive plants in all years.

(2) The sum of "Insulated or Covered Wire and Cable" and "ACSR and Bare Cables" item from the U.S. Department of Commerce, BDSA, Aluminum and Magnesium Division reports entitled "Gross Shipments of Aluminum Mill Shapes by Integrated and Non-Integrated Producers" for the period in question.

(3) The sum of the following:

(a) "Integrated Producers" shipments taken from reports in note (2) above, increased by addition of shipments of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production; and

(b) "Primary Producers or Affiliates" shipments of "Insulated or Covered Wire and Cables" reported in the U.S Department of Commerce, BDSA, Aluminum and Magnesuim Division report dated November 8, 1961, entitled "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960."

(4) The sum of the following:

(a) "Non-Integrated Producers" shipments, taken from reports in note (2) above, decreased by subtracting shipments of merged companies for years prior to merger, obtained from documents and answers supplied by Plaintiff in answer to Defendants' Interrogatories and Document Production; and

(b) "Other Producers" shipments of "Insulated or Covered Wire and Cable" reported in the U.S. Department or Commerce, BDSA, Aluminum and Magnesium Division report dated November 8, 1961, entitled "Shipments of Wire by Primary Producers or Affiliates (Including Merged Companies) and Other Producers, 1954–1960."

(5) Shipments reported by Alcoa and Rome to U.S. Department of Commerce on Form BDSAF-122 during the period in question.

[fol. 6582] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 65

Copper and Aluminum Utilization in Weatherproof Wire
(Thousands of Dollars)

	1958 Total	1958 Aluminum	1958 Copper	1959 Total	1959 Aluminum	1959 Copper
Total—Census of Manufactures [1]	$37,988					
Alcoa [2]	$ 1,368	$1,368	....	$1,447	$1,447	......
Anaconda Co.[4]	5,690	1,749	$3,941		[5]	
General Cable Corp.[4] ...	4,464	1,027	3,437	4,983	1,087	$3,896
Kaiser Alum. & Chemical Corp.[4]	788	788			[5]	
Olin Mathieson Chemical.		[5]			[5]	
Reynolds Metals					[5]	
Rome Cable [3]	2,221	482	1,739	2,235	332	1,903
Southwire Co.[4]		[5]	825		[5]	

Other Companies Known to Manufacture Weatherproof—No Data Available

American Insulated Wire Corp.
Circle Wire & Cable
Collyer Insulated Wire Co.
General Electric Co.
Hendrix Wire & Cable Copr.
Kennecott Copper
Narragansett Wire & Cable Co.
Nehring Electrical Works
Roeblings, John A. & Sons Corp.
Triangle Conduit & Cable Co.
United States Steel Corp.

Notes:

[1] 1958 Census of Manufactures, U.S. Department of Commerce, Bureau of Census, Preprint Report No. MC 58(2)-33D, "Nonferrous Metal Mill and Foundry Products," Table 6A, page 33D-23. S.I.C. codes 33579-31, 33579-37 and 33579-39, ("Weatherproof and slow burning wire").

[2] Dollar sales as shown in Table I (page 5) of Defendants' Answers to Plaintiff's Interrogatories.

[3] Dollar sales as shown in Table I (page 8) of Defendants' Answers to Plaintiff's Interrogatories.

[4] Other companies' sales data from documents supplied Defendants by Department of Justice pursuant to Defendants' R-34 Motion.

[5] Quantities reported—no dollar values.

[fol. 6583]

In United States District Court

Defendants' Exhibit 66

Copper and Aluminum Utilization in Service Drop Cable
(Thousands of Dollars)

	1958 Total	1958 Aluminum	1958 Copper	1959 Total	1959 Aluminum	1959 Copper
Total—Census of Manufactures (1)	$28,053					
Alcoa (2)	$ 2,841	$2,841	......	$3,410	$3,410	......
Anaconda Co. (4)	3,683	3,472	$211		(5)	
General Cable Corp. (4)	2,610	2,432	178	3,485	3,194	$291
Kaiser Alum. & Chemical Corp.		(5)			(5)	
Olin Mathieson Chemical		(5)			(5)	
Reynolds Metals					(5)	
Rome Cable (3)	1,528	1,250	278	1,643	1,327	316
Southwire Co. (4)	889	812	77		(5)	

Other Companies Known to Manufacture Service Drop—No Data Available

Central Cable Corp.
Circle Wire and Cable
Collyer Insulated Wire Co.
General Electric Co.
Kennecott Copper
Narragansett Wire & Cable
Nehring Electrical Works
Phelps Dodge

Notes:

(1) 1958 Census of Manufactures, U.S. Department of Commerce, Bureau of Census, Preprint Report No. MC 58(2)-33D, "Nonferrous Metal Mill and Foundry Products," Table 6A, page 33D-23. S.I.C. codes 33579-44, 33579-45, ("Service Cable, Rubber" and "Service Cable, Thermoplastic").

(2) Dollar sales as shown in Table I (page 5) of Defendants' Answers to Plaintiff's Interrogatories.

(3) Dollar sales as shown in Table I (page 9) of Defendants' Answers to Plaintiff's Interrogatories.

(4) Other companies' sales data from documents supplied Defendants by Department of Justice pursuant to Defendants' R-34 Motion.

(5) Quantities reported—no dollar values available.

[fol. 6584] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 67

Copper and Aluminum Utilization in Weatherproof and Service Drop Cable
(Thousands of Dollars)

	1958 Total	1958 Aluminum	1958 Copper	1959 Total	1959 Aluminum	1959 Copper
Total—Census of Manufactures (1)	$66,041					
Alcoa (2)	$ 4,209	$4,209	......	$4,857	$4,857	......
Anaconda Co.(4)	9,373	5,221	$4,152		(5)	
General Cable Corp.(4)	7,074	3,459	3,615	8,468	4,281	$4,187
Kaiser Alum. & Chemical Corp.(4)		788(6)			(5)	
Olin Mathieson Chemical		(5)			(5)	
Reynolds Metals Co.					(5)	
Rome Cable (3)	3,749	1,732	2,017	3,878	1,659	2,219
Southwire Co.(4)		812(7)	902		(5)	

Other Companies Known to Manufacture Weatherproof and/or Service Drop Cable—No Data Available

American Insulated Wire Corp.
Central Cable Corp.
Circle Wire and Cable
Collyer Insulated Wire Co.
General Electric Co.
Hendrix Wire & Cable Corp.
Kennecott Copper
Narragansett Wire & Cable Co.
Nehring Electrical Works
Phelps Dodge
Roeblings, John A. & Sons Corp.
Triangle Conduit & Cable Co.
United States Steel Corp.

Notes:

(1) 1958 Census of Manufactures, U.S. Department of Commerce, Bureau of Census, Preprint Report No. MC 58(2)-33D, "Nonferrous Metal Mill and Foundry Products," Table 6A, page 33D-23. S.I.C. codes 33579-31, 33579-37, 33579-39, 33579-44 and 33579-45.

(2) Dollar sales as shown in Table I (page 5) of Defendants' Answers to Plaintiff's Interrogatories.

(3) Dollar sales as shown in Table I (pages 8-9) of Defendants' Answers to Plaintiff's Interrogtories.

(4) Other companies' sales data from documents supplied Defendants by Department of Justice pursuant to Defendants' R-34 Motion.

(5) Quantities reported for both weatherproof and service drop, but no dollar values available.

(6) Weatherproof only.

(7) Service Drop only.

THE ALUMINUM ASSOCIATION
420 LEXINGTON AVENUE
NEW YORK 17, NEW YORK

DEFENDANTS' EXHIBIT 69

Revised: May 1, 1961
Supersedes: November 15, 1960

U. S. Dist. Court

REGISTRATION RECORD OF ALUMINUM ASSOCIATION ALLOY DESIGNATIONS AND CHEMICAL COMPOSITION LIMITS FOR WROUGHT ALUMINUM ALLOYS

Chemical Composition Limits ① in Per cent

aL69 24

Only compositions which conform to those listed herein and are registered with the Aluminum Association should be designated as "AA" alloys

AA Number	Former Designation	Registered by	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Nickel	Zinc	Titanium	Others ③ Each	Others ③ Total	Aluminum Min ④⑤
EC ③	EC													99.45
1100	2S		1.0 Si + Fe		0.20	0.05				0.10		0.05 (25)	0.15	99.00
1200	A2S		1.0 Si + Fe		0.10	0.05				0.10		0.05	0.15	99.00
1030	A81S		0.30	0.6	0.10	0.05	0.05			0.05	0.03	0.03		99.30
1130 ⑦	E20S		0.7 Si + Fe		0.20							0.05		99.30
1230 (11)	99.3		0.7 Si + Fe		0.10	0.05				0.10		0.05		99.30
1330	[illegible]		0.7 Si + Fe		0.20					0.10		0.05		99.30
1135		Alcoa	0.65 Si + Fe		0.20	0.04						0.05		99.35
1235 ⑨	[illegible],99.35		0.65 Si + Fe		0.05							0.05		99.35
1335		Kaiser	0.15	0.20-0.50							0.03	0.05		99.35
1435		Kaiser	0.15	0.20-0.50	0.02							0.05		99.35
1145 ⑥	[illegible]		0.55 Si + Fe		0.05	0.05					0.03	0.03		99.45
1345		Alcoa	(12)	(12)	0.04	0.03	0.01	0.03	0.01	0.03	0.03	(13)		99.45
1348 (25)		Alcoa	0.30	0.60	0.10							0.05		99.45
1050	A81S		0.25	0.40	0.05	0.05	0.05			0.05	0.03	0.03		99.50
1150		Kaiser	0.45 Si + Fe		0.20							0.05		99.50
1250		Alcoa	0.30	0.40	0.10	0.01	0.01	0.01		0.05	(13)	0.03 (14)		99.50
1060	[illegible]		0.25	0.35	0.05	0.03	0.03			0.05	0.03	0.03 (25)		99.60
1160	C2S,99.6		Canceled April 22, 1958. Superseded by 1060											
1260	[illegible]		0.40 Si + Fe		0.04	0.01						0.03 (25)		99.60
1360		*AATC	0.40 Si + Fe		0.04	0.03						0.03		99.60
1165		Kaiser	0.08	0.10	0.10-0.20	0.03	0.03	0.03		0.03	0.03	0.03	0.10	99.65
1070	AC1S		0.20	0.25	0.04	0.03	0.03			0.04	0.03	0.03		99.70
1170	FC1S		0.30 Si + Fe		0.03	0.03	0.03	0.03		0.03	0.03	0.03		99.70
1270	EC1S		0.30 Si + Fe		0.01	0.01						0.03		99.70
1075	JC1S		0.20	0.20	0.04	0.03	0.03			0.04	0.03	0.03		99.75
1175 ⑤	99.75		0.15 Si + Fe		0.10							0.02		99.75
1080	EC1S,99.80		0.15	0.15	0.03	0.02	0.02			0.03	0.03	0.02		99.80
1180 (15)	CC1S,99.8		0.09	0.09	0.01						0.03	0.02		99.80
1085	AB1S		0.10	0.12	0.03	0.03	0.03			0.03	0.02	0.01 (25)		99.85
1185	CB1S		0.15 Si + Fe		0.01							0.03		99.85
1285	[illegible]		0.08 (13)	0.08 (13)	0.02					0.03	0.03	0.01 (25)		99.85
1187 (11)	[illegible],99.87		Canceled September 10, 1958. Superseded by 1188.											
1188 (25)	[illegible]		0.06	0.06	0.005	0.01	0.01			0.03	0.01	0.01 (25)		99.88
1090	FB1S		0.07	0.07	0.02	0.01	0.01			0.03	0.01	0.01 (25)		99.90
1095	AA1S		0.030	0.040	0.010	0.010	0.010			0.010	0.005	0.005		99.95
1197 (11)	CA1S		Canceled September 10, 1958. Superseded by 1199.											
1099	BA1S													
1199 (11)		Alcoa	0.006	0.006	0.006		0.006			0.006		0.002		99.99
2011	11S		0.40	0.7	5.0-6.0					0.30		0.05 (18)	0.15	Remainder
2014	14S,X301 core		0.50-1.2	1.0	3.9-5.0	0.40-1.2	0.20-0.8	0.10		0.25	0.15	0.05 (25)	0.15	Remainder
X2214	XB14S		0.50-1.2	0.25	3.9-5.0	0.40-1.2	0.20-0.8	0.10		0.25	0.15	0.05	0.15	Remainder
X2216	XB16S		Canceled September 22, 1960											
X2316	XC16S		0.50-1.5	1.2	3.5-5.0	0.50-1.0	0.30-0.8		0.6	0.6		0.15 (28)	0.30	Remainder
2017	17S		0.8	1.0	3.5-4.5	0.40-1.0	0.20-0.8	0.10		0.25		0.05	0.15	Remainder
2117	A17S		0.8	1.0	2.2-3.0	0.20	0.20-0.50	0.10		0.25		0.05	0.15	Remainder
2018	18S		0.9	1.0	3.5-4.5	0.20	0.45-0.9	0.10	1.7-2.3	0.25		0.05	0.15	Remainder
2218	B18S		0.9	1.0	3.5-4.5	0.20	1.2-1.8	0.10	1.7-2.3	0.25		0.05	0.15	Remainder
2618	F18S,RR58		0.25	0.9-1.3	1.9-2.7		1.3-1.8		0.9-1.2		0.04-0.10	0.05	0.15	Remainder
X2119	XA19S		0.40	0.60	5.8-6.4	0.17-0.23					0.10-0.20	0.05	0.15	Remainder
2219		Alcoa	0.20	0.30	5.8-6.8	0.20-0.40	0.02			0.10	0.02-0.10	0.05 (17)	0.15	Remainder
2319 (27)		Alcoa	0.20	0.30	5.8-6.8	0.20-0.40	0.02			0.10	0.10-0.20	0.05 (17)	0.15	Remainder
X2020		Alcoa	0.40	0.40	4.0-5.0	0.30-0.8	0.03			0.25	0.10	0.05	0.15	Remainder
2024	24S		0.50	0.50	3.8-4.9	0.30-0.9	1.2-1.8	0.10		0.25		0.05	0.15	Remainder
2025	25S		0.50-1.2	1.0	3.9-5.0	0.40-1.2	0.05	0.10		0.25	0.15	0.05	0.15	Remainder
2225	B25S		0.50-1.2	0.30	3.9-5.0	0.40-1.2	0.05	0.10		0.25	0.15	0.05	0.15	Remainder
3003	3S		0.6	0.7	0.20	1.0-1.5				0.10		0.05 (28)	0.15	Remainder
X3103		Harvey	Canceled September 22, 1960											
3004	4S		0.30	0.7	0.25	1.0-1.5	0.8-1.3			0.25		0.05 (28)	0.15	Remainder
X3005	XA3S		0.6	0.7	0.25	1.0-1.5	0.20-0.6	0.10		0.25	0.10	0.05	0.15	Remainder
3105		Alcoa	0.6	0.7	0.40	0.30-1.5	0.20-0.8	0.25		0.40	0.10	0.05	0.15	Remainder
3205		Reynolds	0.6	0.7	0.25	0.10-1.5	0.10-0.6	0.10		0.25	0.10	0.05	0.15	Remainder
4001		Reynolds	1.5-2.5	0.8	0.20	0.10	0.05			0.10	0.15	0.05	0.15	Remainder
4101		Reynolds	1.5-3.0	0.8	0.20	0.10	0.10-0.50			0.10		0.05	0.15	Remainder
4032	32S		11.0-13.5	1.0	0.50-1.3		0.8-1.3	0.10	0.50-1.3	0.25		0.05	0.15	Remainder
4043	43S,X145		4.5-6.0	0.8	0.30	0.05	0.05			0.10	0.20	0.05 (25)	0.15	Remainder
4343 (19)	C43S,44S,X143		6.8-8.2	0.8	0.25	0.10				0.20		0.05	0.15	Remainder
4543	XB43S		5.0-7.0	0.50	0.10	0.05	0.10-0.40	0.05		0.10	0.10	0.05	0.15	Remainder
4045	45S		9.0-11.0	0.8	0.30	0.05	0.05			0.10	0.20	0.05	0.15	Remainder
4145 (19)		Alcoa	9.3-10.7	0.8	3.3-4.7	0.15	0.15	0.15		0.20		0.05	0.15	Remainder
4245 (19)		Alcoa	9.3-10.7	0.8	3.3-4.7	0.07	0.07	0.07		9.3-10.7		0.05	0.15	Remainder
4047 (19)	X47S		11.0-13.0	0.8	0.30	0.15	0.10			0.20		0.05	0.15	Remainder
X5001		Revere	Canceled April 28, 1960											
X5002		Kaiser	0.10	0.15	0.10-0.20		0.9-1.5					0.05	0.15	Remainder
X5003		Kaiser	Canceled April 28, 1960											
X5004		Bridgeport			0.20 (18)		1.0 (18)							Remainder
5005	A50S,X50A,X155		0.40	0.7	0.20	0.20	0.50-1.1	0.10		0.25		0.05	0.15	Remainder
5105		Revere	Canceled April 28, 1960											
5305		Kaiser	0.15	0.7	0.10	0.20	0.50-1.1	0.10		0.25		0.05	0.15	Remainder
X5405	XD50S						0.50-1.1						0.03	Remainder
X5006	XE52S		Canceled September 22, 1960											
5007		Consolidated	0.006	0.006	0.004	0.001	0.40-0.6	0.001	0.001	0.003	0.002	0.002		99.35

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Chemical Composition Limits ① ② (Continued)

Only compositions which conform to those listed herein or are registered with The Aluminum Association should be designated as "AA" alloys.

AA Number	Former Designation	Registered By	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Nickel	Zinc	Titanium	Others Each ③	Others Total	Aluminum Min ③ ②
[illegible]	....	Consolidated	0.006	0.006	0.006	0.001	0.8-1.1	0.001	0.001	0.002	0.002	0.002	....	99.86
[illegible]	....	Consolidated	0.006	0.006	0.006	0.006	1.0-2.3	0.006	0.006	0.003	0.003	0.002	....	97.75
X5250	....	Bridgeport	.....	.....	.....									
X5?50		Alcoa	0.30	0.7	0.25	[illegible]	1.0-1.3	[illegible]	[illegible]	0.25	....	0.05	0.15	Remainder
5?50	5?0	.....	0.40	0.7	0.20	0.10	1.0-1.5	0.10	.....	0.25	.....	0.05 ⑩	0.15	Remainder
5052	52S	.....	0.45 Si + Fe		0.10	0.10	2.2-2.8	0.15-0.35	.....	0.10	.....	0.05 ⑩	0.15	Remainder
5152	....	Kaiser	0.40	0.50	0.30	0.20	2.0-3.0	0.25	.....	0.25	.....	0.05	0.15	Remainder
5252	....	Kaiser	0.08	0.10	0.10	0.10	2.2-2.8	.....	.....	.....	.....	0.03	0.10	Remainder
5652	F52S	.....	0.40 Si + Fe		0.04	0.01	2.2-2.8	0.15-0.35	.....	0.10	.....	0.05 ⑩	0.15	Remainder
5154	A54S	.....	0.45 Si + Fe		0.10	0.10	3.1-3.9	0.15-0.35	.....	0.20	0.20	0.05 ⑩	0.15	Remainder
5254	B54S	.....	0.45 Si + Fe		0.05	0.01	3.1-3.9	0.15-0.35	.....	0.20	0.05	0.05 ⑩	0.15	Remainder
5454	....	Alcoa	0.40 Si + Fe		0.10	0.50-1.0	2.4-3.0	0.05-0.20	.....	0.25	0.20	0.05	0.15	Remainder
5554 ⑪	....	Alcoa	0.40 Si + Fe		0.10	0.50-1.0	2.4-3.0	0.05-0.20	.....	0.25	0.05-0.20	0.05 ⑩	0.15	Remainder
X5056	X56S		Canceled October 19, 1956.											
5156	.....	Reynolds	0.30	0.7	0.25	0.20-0.6	3.5-5.0	0.05-0.25	.....	0.25	0.15	0.05	0.15	Remainder
5056	56S	.....	0.30	0.40	0.10	0.05-0.20	4.5-5.6	0.05-0.20	.....	0.10	.....	0.05 ⑩	0.15	Remainder
X5156	....	Kaiser	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	....	.....
5356	X56S	.....	0.50 Si + Fe		0.10	0.05-0.20	4.5-5.5	0.05-0.20	.....	0.10	0.06-0.20	0.05 ⑩	0.15	Remainder
5456	....	Alcoa	0.40 Si + Fe		0.10	0.50-1.0	4.7-5.5	0.05-0.20	.....	0.20	0.20	0.05	0.15	Remainder
5556 ⑪	....	Alcoa	0.40 Si + Fe		0.10	0.50-1.0	4.7-5.5	0.05-0.20	.....	0.25	0.05-0.20	0.05 ⑩	0.15	Remainder
5057		Reynolds	0.08	0.10	0.10	0.03	0.20-0.6	.....	.....	0.03	.....	0.03	0.05	Remainder
5257	C57S,K157	....	0.12	0.17	0.20	0.15-0.45	0.8-1.2	.....	.....	.....	.....	0.05	0.15	Remainder
5457	....	Alcoa	0.08	0.10	0.20	0.15-0.45	0.8-1.2	.....	.....	.....	.....	0.03	0.10	Remainder
5557	....	Alcoa	0.10	0.12	0.15	0.10-0.40	0.40-0.8	.....	.....					
5657	....	Reynolds	0.08	0.10	0.10	0.03	0.6-1.0		.....		.....	0.03	0.10	Remainder
5757	....	Alcoa	0.08	0.10	0.06-0.15		0.6-1.0		.....	0.03		0.03	0.05	Remainder
5857	....	Olin	0.08	0.12	0.06-0.20	.....	0.6-1.0	0.06-0.15	.....	.....	0.03	0.03	0.10	Remainder
5957	....	Kaiser	0.40	0.7	0.25	0.15	0.50-0.8	.....	.....	.....	.....	0.03	0.10	Remainder
5?57	....					0.10-0.50	0.60-0.8	0.15	.....	0.25	.....	0.05	0.15	Remainder
5083	LK183		0.40	0.40	0.10	0.30-1.0	4.0-4.9	0.05-0.25	.....	0.25	0.15	0.05	0.15	Remainder
5183 ⑪	....	Kaiser	0.40	0.40	0.10	0.50-1.0	4.3-5.2	0.05-0.25	.....	0.25	0.15	0.05 ⑩	0.15	Remainder
X5084	....	Kaiser	0.40	0.40	.....	0.8	5.0 ⑬	0.10 ⑬	.....	2.0 ⑬	.....			Remainder
X5184 ⑪	....	Kaiser	0.40	0.40		0.8	5.4 ⑬	0.10	.....	2.0 ⑬	0.15	0.05 ⑩	0.15	Remainder
5086	K186	.....	0.40	0.50	0.10	0.20-0.7	3.5-4.5	0.05-0.25	.....	0.25	0.15	0.05	0.15	Remainder
6001 ⑪	....	Reynolds	Canceled July 8, 1955. Superseded by 6101											
6101 ⑪	....	Reynolds	0.30-0.7	0.50	0.10	0.03	0.35-0.8	0.03	.....	0.10	.....	0.03 ⑩	0.10	Remainder
6201 ⑪		Revere												
6003 ⑪	53S,K163	Kaiser	0.35-1.0	0.6	0.10	0.8	0.8-1.5	0.35	.....	0.20	0.10	0.05	0.15	Remainder
[illegible]			0.50-0.9	0.50	0.10	0.03	0.6-0.9	0.03	.....	0.10	.....	0.03 ⑩	0.10	Remainder
6011	8S11	.....	0.6-1.2	1.0	0.40-0.9	0.8	0.6-1.2	0.30	0.20	1.5	0.20	0.05	0.15	Remainder
6051	51S	.....	0.6-1.2	1.0	0.15	0.20	0.45-0.8	.....	.....	0.25	.....	0.05	0.15	Remainder
6151	A51S	.....	0.6-1.2	1.0	0.35	0.20	0.45-0.8	0.15-0.35	.....	0.25	0.15	0.05	0.15	Remainder
X6251	XB51S	.....	0.6-1.2	0.20	0.05	0.20	0.45-0.8	0.15-0.35	.....	0.25	0.15	0.05	0.15	Remainder
6351		Kaiser	0.7-1.3	0.50	0.10	0.40-0.8	0.40-0.8	.....	.....		0.20	0.05	0.15	Remainder
6061	J51S,K160	.....	0.20-0.50	0.8	0.15-0.40	0.10	0.40-0.8	.....	.....	0.20	.....	0.05	0.15	Remainder
6053	53S	.....	⑬	0.35	0.10	.....	1.1-1.4	0.15-0.35	.....	0.10	.....	0.05	0.15	Remainder
6253 ⑪	B53S	.....	⑬	0.50	0.10	.....	1.0-1.5	0.15-0.35	.....	1.6-2.4	.....	0.05	0.15	Remainder
6353	C53S	.....	Canceled September 22, 1960											
X6453	XD53S	.....	Canceled September 22, 1960											
6553	E53S	.....	Canceled September 22, 1960											
6061	61S	.....	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.15-0.35	.....	0.25	0.15	0.05	0.15	Remainder
X6161	....	Kaiser	0.40-0.8	0.10	0.15-0.40	0.15	0.8-1.2	0.15-0.35	.....	0.25	0.15	0.05	0.15	Remainder
6062	62S	.....	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.04-0.14	.....	0.25	0.15	0.05	0.15	Remainder
X6162	....	Reynolds	.....	.....		.....			.....					
6262	....	Alcoa	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.04-0.14	.....	0.25	0.15	0.05 ⑪	0.15	Remainder
6063	63S	.....	0.20-0.6	0.35	0.10	0.10	0.45-0.9	0.10	.....	0.10	0.10	0.05	0.15	Remainder
X6163	....	Alcoa	0.30-0.50	0.03	0.01	0.01	0.50-0.8	0.005	0.001	0.01	.....	0.003 ⑬	....	Remainder
6263 ⑪	....	Revere	Canceled July 12, 1955. Superseded by 6101											
6363	....	Alcoa	0.20-0.6	0.35	0.05	0.01	0.45-0.9	0.10	.....	0.10	0.10	0.05	0.15	Remainder
6463	....	Alcoa	0.20-0.6	0.15	0.20	0.05	0.45-0.9	.....	.....	.....	.....	0.03	0.15	Remainder
6563	....	Alcoa	0.20-0.45	0.15	0.15	0.05	0.35-0.7	.....	.....	.....	.....	0.05	0.15	Remainder
X6064	X64S	.....	0.40-0.8	0.30	0.15-0.40	0.03	0.8-1.2	0.03	.....	0.10	.....	0.03 ⑩	0.10	Remainder
X6164	XA64S	.....	Canceled September 22, 1960											
6264	B64S	.....	Canceled September 22, 1960											
6066	66S	.....	0.9-1.8	0.50	0.7-1.2	0.6-1.1	0.8-1.4	0.40	.....	0.25	0.20	0.05	0.15	Remainder
7001	XDX10u	.....	0.35	0.40	1.6-2.6	0.20	2.6-3.4	0.18-0.40	.....	6.8-8.0	0.20	0.05	0.15	Remainder
7070	70S	.....	Canceled September 22, 1960											
X7370	XC70S	.....	Canceled September 22, 1960											
7072 ⑪	72S	.....	0.7 Si + Fe		0.10	0.10	0.10	.....	.....	0.8-1.3	.....	0.05	0.15	Remainder
X7272	XB72S	.....	0.7 Si + Fe		0.10	0.10	0.10	.....	.....	2.2-2.8	.....	0.05	0.15	Remainder
7372	....	Alcoa	.....		.....			.....	.....					
7472		Alcoa	0.25	0.6	0.05	0.05	0.9-1.5	.....	.....	1.3-1.9	.....	0.05	0.15	Remainder
X7073	X73S	.....	Canceled September 22, 1960											
7075	75S	.....	0.50	0.7	1.2-2.0	0.30	2.1-2.9	0.18-0.40	.....	5.1-6.1	0.20	0.05	0.15	Remainder
7175	....	Alcoa	0.15	0.20	1.2-2.0	0.10	2.1-2.9	0.18-0.30	.....	5.1-6.1	0.10	0.05	0.15	Remainder
X7275		Kaiser	0.10 Si + Fe		1.2-2.0	0.30	2.1-2.9	0.18-0.40	.....	5.1-6.1	0.10	0.03	0.10	Remainder
X7375	XC75S	.....	Canceled September 22, 1960											
7076	76S	.....	0.40	0.6	0.30-1.0	0.30-0.8	1.2-2.0		.....	7.0-8.0	0.20	0.05	0.15	Remainder
7277	B77S	.....	0.50	0.7	0.8-1.7	.....	1.7-2.3	0.18-0.35	.....	3.7-4.3	0.10	0.05	0.15	Remainder
7178	XA78S													
7079	X79S	.....	0.50	0.7	1.6-2.4	0.30	2.4-3.1	0.18-0.40	.....	6.3-7.3	0.20	0.05	0.15	Remainder
7179	.....	Alcoa	0.30	0.40	0.40-0.8	0.10-0.30	2.9-3.7	0.10-0.25	.....	3.8-4.8	0.10	0.05	0.15	Remainder
X7279	....	Kaiser	0.15	0.20	0.40-0.8	0.10-0.30	2.9-3.7	0.10-0.25	.....	3.8-4.8	0.10	0.05	0.15	Remainder
X8001	....	Alcoa	0.10 Si + Fe		0.40-0.8	0.10-0.30	2.9-3.7	0.10-0.25	.....	3.8-4.8	0.10	0.03	0.10	Remainder
			0.17	0.45-0.7	0.15	.....		.....	0.9-1.3	.....	.....	0.05 ⑭	0.15	Remainder
X8002	....	Alcoa	0.25	1.2-1.6	0.05	.....	....	.....	1.2-1.6	.....	.....	0.05 ⑭	0.15	Remainder
X8003	....	Alcoa	0.03	1.2-1.6	.....	.....		.....	1.2-1.6	.....	.....	⑭	0.03	Remainder
8112	K112	.....	1.0	1.0	0.40	0.6	0.7	0.20	.....	1.0	.....	0.05	0.15	Remainder
8212	....	Kaiser	1.0	1.0	0.10-0.40 ⑬	0.15-0.50 ⑬	0.05-0.35 ⑬	0.20	.....	1.0	.....	0.05	0.15	Remainder
8013		Kaiser	0.25 Si + Fe											
X8280	XB80S	.....	1.0-2.0	0.7	0.7-1.3	0.10	.....	0.20-0.50	0.20-0.7	.....	0.10	0.03	0.10	Remainder
XA380	XC80S	.....	0.40	0.7	1.7-2.3	0.10	0.6-0.9	.....	0.9-1.5	.....	0.10	0.05 ⑮	0.15	Remainder
X8480	XD80S	.....	0.7	0.7	0.7-1.3	0.10		.....	0.7-1.3	.....	0.20	.... ⑮	0.30	Remainder
8099	K399		....	....	.....				.....	.....	0.20	.... ⑮	0.30	Remainder
													....	98.7 ⑤

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THE ALUMINUM ASSOCIATION
420 LEXINGTON AVENUE
NEW YORK 17, NEW YORK

Revised: May 1, 1961
Supersedes: November 15, 1960

Footnotes to Table of Chemical Composition Limits on Pages 1 and 2

① Composition in percent maximum unless shown as a range, a minimum or a nominal value.

Standard limits for alloying elements and impurities are expressed to the following places:

Less than 1/1000 percent	.0.000X
1/1000 to 1/100 percent	.0.00X
1/100 to 1/10 percent	
Unalloyed aluminum made by a refining process	.0.0XX
Alloys and unalloyed aluminum not made by a refining process	.0.0X
1/10 through 1/2 percent	.0.XX
Over 1/2 percent	.0.X, X.X, etc.

② For purposes of determining conformance to these limits, an observed value or a calculated value obtained from analysis is rounded off to the nearest unit in the last right-hand place of figures used in expressing the specified limit, in accordance with the following:

American Standard Rules for Rounding Off Numerical Values (ASA Z25.1)

When the figure next beyond the last figure or place to be retained is less than 5, the figure in the last place retained should be kept unchanged.

When the figure next beyond the last figure or place to be retained is greater than 5, the figure in the last place retained should be increased by 1.

When the figure next beyond the last figure or place to be retained is 5 and

(a) there are no figures, or only zeros, beyond this 5, if the figure in the last place to be retained is odd, it should be increased by 1; if even, it should be kept unchanged.

(b) if the 5 next beyond the figure in the last place to be retained is followed by any figures other than zero, the figure in the last place retained should be increased by 1, whether odd or even.

③ Analysis is regularly made only for the elements for which specific limits are shown, except for unalloyed aluminum. If, however, the presence of other elements is suspected, or indicated in the course of routine analysis, further analysis is made to determine that these other elements are not in excess of the amount specified.

④ The aluminum content for unalloyed aluminum made by a refining process is the difference between 100.000 percent and the sum of all other metallic elements present in amounts of 0.001 percent or more each, expressed to the third decimal.

⑤ The aluminum content for unalloyed aluminum not made by a refining process is the difference between 100.00 percent and the sum of all other metallic elements present in amounts of 0.010 percent or more each, expressed to the second decimal.

⑥ Electric conductor

⑦ Reflector sheet.

⑧ Foil.

⑨. Cladding on clad 1100 and clad 3003 reflector sheet.

⑩ Capacitor alloy.

⑪ Cladding on alclad 2024.

⑫ Silicon, max., 50 percent of iron.

⑬ Bismuth, lead, tin, 0.01 max. each; lithium, 0.008 max.; cadmium, 0.003 max.; boron, cobalt 0.001 max each.

⑭ Titanium plus vanadium, 0.02 max.

⑮ Silicon plus iron, 0.14 max.

⑯ Lead, bismuth, 0.20-0.6 each.

⑰ Vanadium, 0.05-0.15; zirconium, 0.10-0.25.

⑱ Nominal percentage.

⑲ Brazing alloy.

⑳ Bus conductor.

㉑ Cladding on alclad 2014.

㉒ Silicon, 45-65 percent of magnesium.

㉓ Boron, 0.06 max.

㉔ Boron, cobalt, 0.001 max. each; cadmium, 0.003 max.; lithium, 0.008 max.

㉕ Tin, 5.5-7.0.

㉖ Beryllium 0.0008 maximum for welding electrode and filler wire only.

㉗ Welding electrode

㉘ Mechanical wire.

㉙ Gallium 0.02 max.

㉚ Cadmium 0.10-0.35; lithium 0.9-1.7.

㉛ Cladding on alclad 5056.

㉜ Cladding on alclad 3003, alclad 3004, alclad 5050, alclad 5155, alclad 6061, alclad 7075, and alclad 7178.

㉝ Total copper + manganese + magnesium at least 0.7.

㉞ Lead 0.30 max.

㉟ Tin 0.005 max; sodium 0.005 max.

㊱ Conductor alloy.

㊲ Lead, bismuth 0.40-0.7 each.

* Aluminum Association Technical Committee.

† AA number registered since previous issue.

‡ Composition limits registered since previous issue.

¶ Composition limits revised since previous issue.

§ "X" removed from AA number since previous issue.

○ Canceled since previous issue.

THE ALUMINUM ASSOCIATION
420 LEXINGTON AVENUE
NEW YORK 17, NEW YORK

Revised: May 1, 1961
Supersedes: November 15,

Components of Clad Products

DESIGNATION	COMPONENT ALLOYS ①		TOTAL THICKNESS OF COMPOSITE PRODUCT Inches	SIDES CLAD	NOMINAL CLADDING THICKNESS PER SIDE ② Percent of Composite Thickness
	CORE	CLADDING			
Alclad 2014 sheet and plate	2014	6003	Under 0.025 0.025-0.039 0.040-0.099 0.100 and over	Both Both Both Both	10 7 1/2 5 2 1/2
Alclad 2024 sheet and plate	2024	1230	Under 0.063 0.063-0.187 0.188 and over	Both Both Both	5 2 1/2 1 1/2, 2 1/2 ④⑤
Alclad 3003 sheet and plate	3003	7072	All Under 0.065 0.065 and over	Both One One	10 15 7 1/2
Alclad 3003 tube	3003	7072	All All	Inside Outside	10 7
Alclad 3004 sheet and plate	3004	7072	All	Both	5
Alclad 5050 sheet and plate	5050	7072	All	Both	5
Alclad 5155 sheet and plate	5155	7072	All	Both	5
Alclad 5056 rod and wire	5056	6253	All	Outside	20% of total cross-sectional area
Alclad 6061 sheet and plate	6061	7072	All	Both	5
Alclad 7075 sheet and plate	7075	7072	Under 0.063 0.063-0.187 0.188 and over	Both Both Both	4 2 1/2, 4 ③ 1 1/2, 4 ③⑤
Alclad 7178 sheet and plate	7178	7072	All	Both	4
No. 11 brazing sheet	3003	4343	Under 0.064 0.064 and over	One One	10 5
No. 12 brazing sheet	3003	4343	Under 0.064 0.064 and over	Both Both	10 5
No. 21 brazing sheet	6951	4343	Under 0.091 0.091 and over	One One	10 5
No. 22 brazing sheet	6951	4343	Under 0.091 0.091 and over	Both Both	10 5
Clad 1100 reflector sheet	1100	1175	Under 0.065 0.065 and over	One or Both	15 7 1/2
Clad 3003 reflector sheet	3003	1175	Under 0.065 0.065 and over	One or Both	15 7 1/2

① Cladding composition is applicable only to the aluminum or aluminum alloy which is bonded to the alloy ingot or slab preparatory to rolling to the specified composite product. (The composition of the cladding may be subsequently altered by diffusion between the core and cladding due to thermal treatment.)

② Average minimum thickness of cladding of sheet and plate after rolling to the specified thickness of the composite product will be 80 percent of the nominal as determined by averaging cladding thickness measurements taken at a magnification of 100 diameters on the cross section of samples polished and etched for microscopic examination.

③ Nominal cladding thickness of 4 percent is now obsolete for alclad 7075 sheet and plate in these thickness ranges and is shown for information only.

④ Alclad 2024 sheet and plate in thicknesses of 0.1[illegible] inch and over are furnished with a nominal cladding thickness of 2 1/2 percent unless the thinner cladd[illegible] is specifically designated.

⑤ For thicknesses of 0.500 inch and over with 1 1/2 percent nominal cladding thickness, the average maxi[illegible]mum thickness of cladding after rolling to the speci[illegible]fied thickness of composite plate will be 3 percent [illegible] the composite thickness, as determined by averaging cladding thickness measurements taken at a magnifica[illegible]tion of 100 diameters on the cross section of sample[illegible] polished and etched for microscopic examination.

[fol. 6589] In United Stat. ... ct Court

Defendants' Exhibit 70

United States Department of Commerce
Luther H. Hodges, Secretary
Washington 25, D. C.

Business and Defense Services Administration

Fox: WO-7-4604 BD-61-63

For Immediate Release
Tuesday, April 11, 1961

Primary Aluminum Output Gains Strongly

Primary aluminum production in the United States went from 1.4 billion pounds in 1950 to 4 billion pounds in 1960, an increase of 180 percent, while the number of producing companise doubled—3 to 6—in the same period, the Aluminum and Magnesium Division, Business and Defense Services Administration, U.S. Department of Commerce, reported today.

Detailing industry operations over the decade, the Division said that the greatest growth was in companies producing extruded shapes and drawn tube, whose number went from 39 in 1950 to 133 in 1960. The 1960 shipments were 921 million pounds, 210 percent above 1950. Foil producers numbered 16 in 1960, compared with 9 in 1950, and 1960 shipments were 252 million pounds, 145 percent above 1950.

Secondary ingot producers, producing ingot from scrap, numbered 84 in 1960 compared with 63 ten years earlier, and shipments increased 82 percent during the period to 652 million pounds.

Although sheet producers grew in number from 9 to 34 in the 10-year period, shipments increased by only about 48 percent to 1.5 billion pounds.

Further details are given in the appended table:

USCOMM-DC-7523

[fol. 6590] Number of Aluminum Producers and Shipments 1950, 1955, 1960

Product	Number of producers			Shipments[1] Millions of pounds			Percent change
	1950[2]	1955	1960	1950[2]	1955	1960	1950–1960
Primary metal	3	4	6	1,437	3,131	4,029	+180
Secondary ingot	63	77	84	358	599	652	+ 82
Sheet and plate	9	24	34	1,028	1,466	1,525	+ 48
Foil	9	12	16	103	300	252	+145
Extruded shapes & drawn tube	39	110	133	297	767	921	+210
ACSR (aluminum conductor steel reinforced)	12	12	11	133	157	184	+38
Wire and insulated or covered wire and cable	NA	48	47	NA	103	121	NA
Powder and paste	7	9	9	22	37	33	+ 50
Forgings	NA	45	41	NA	70	50	NA

[1] Primary and secondary ingot figures are production as reported by the Bureau of Mines. Other data are gross shipments as reported by the Bureau of the Census and differ from published net shipments, in that gross shipments include shipments between companies in the industry, while net shipments do not.

[2] Captive plants, i.e. plants producing solely for their own further use, are included in 1955 and 1960 but not in 1950; there were very few in that year.

NA—Not available.

[fol. 6591] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 71

List of Companies and Plants Producing Copper Wire and Cable

The kind of wire products and type of covering or insulation are indicated by the letter symbols below:

Insulated wire and cable:	
Rubber & thermosetting synthetics	**A**
Thermoplastic	**B**
Varnished cambric	**C**
Asbestos	**D**
Paper insulated power cable	**E**
Submarine cables (incl. armored)	**F**
Telephone cables:	
Pulp and paper insulated	**G**
Textile insulated	**H**
Plastic insulated	**I**
Magnet wire:	
Enameled and synthetic	**J**
Glass	**K**
Covered, other than glass	**L**
Special military items:	
Field wire	**M**
Spiral 4	**N**
Floating cable	**O**
Shipboard cable (armored)	**P**
Aircraft wire and cable	**Q**
Other	**R**
Coaxial types (high frequency only)	**S**
Tinned and lead alloy (hot dipped) coated wire:	
Round—solid	**T**
Stranded—all types	**U**
Weatherproof (Textile covered):	
Solid	**V**
Stranded	**W**
Other	**X**

Source: Form BDSAF-285, Copper Wire Mill Facility Survey.

U.S. Department of Commerce.
July 10, 1958.

Copper Division
Business and Defense Services Administration

[fol. 6592]

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Accurate Insulated Wire Co. New Haven, Conn.	AB			M				
Ace Wire Mills, Paterson, N. J.			J					
Acme Wire Co., Hamden, Conn.			JKL					
Advance Insulated Wire Co. Metuchen, N. J.	B							
Alden Wire Corp., Oceanside, N. Y.		I						
A-K Mfg. Co., Barrington, Ill.	B			MNQ	S			
Alphaduct Wire & Cable Co. New Brunswick, N. J. (See General Cable)								
American Brass Co., Ansonia, Conn.						T		
American Electric Cable Co. Holyoke, Mass.	BC	HI		MQ				X
American Insulated Wire Corp. Pawtucket, R. I.	ABD	HI				TU	VW	
American Metal Moulding Co., Irvington, N. J.								X
Amphenol Electronics Corp. Chicago, Ill.	B			Q	S			
Ampere Wire & Cable Corp. Yonkers, N. Y.	AB	HI						
Anaconda Wire & Cable Co. Total	ABCEG	IJ	KL	O	S		VW	X
Hastings-on-Hudson, N. Y.	ABCEG	I		O	S		W	
Black Eagle, Mont.								X
Anderson, Indiana			JKL					
Marion, Indiana	AB							
Muskegon, Michigan			JKL					

List of Companies and Plants Producing Copper Wire and Cable

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Orange, California	AB		JKL				VW	
Sycamore, Illinois	AB		JKL				VW	
Anchor Wire Corp., Jamaica, N. Y.								X
Andrew Corp., Orlando Park, Ill.					S			
Ansonia Wire & Cable Co, Ashton, R. I.	BF	HI		P				
[fol. 6593]								
Apex Wire & Cable Corp. Brooklyn, New York	B							
Atlantic Wire & Cable Co. College Point, N. Y.	B							
Automatic Electric Co. Chicago, Illinois		H	JL					
Belden Mfg. Co. Total	AB		JKL					
Chicago Plant			JKL					
Richmond, Ind. Plant	AB							
Bergen Wire Rope Co. Lodi, N. J.				MQ				
Berkshire Electric Cable Co. Leeds, Mass.	B	I		Q	S			
Boston Insulated Wire & Cable Dorchester, Mass.	AB			PQ	S			
Bradford Kyle & Co. Plymouth, Mass.			L					
Brand, Wm. & Co., Inc. Willimantic, Conn.	B			MQ	S			
Bridgeport Brass Co. Housatonic Plant Bridgeport, Conn.								X

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Bridgeport Insulated Wire Total			JKL					
Bridgeport Insulated Wire Co., Bridgeport, Conn.			KL					
Bridgeport Enameled Wire Co., Stratford, Conn.			J					
C & W Insulated Wire Co. Ft. Wayne, Ind.			L					
Calcon Mfg. Co., Washington, Pa.	A							
Camden Wire Co., Camden, N. Y.				M		TU		
Central Cable Corp., Jersey Shore, Pa. Total	AB						VW	
Jersey Shore, Pa.	AB						VW	
Freeport, Ill.	B						VW	
[fol. 6594]								
Chester Cable Corp., Chester, N. Y.	B							
Circle Wire & Cable Corp. Maspeth, New York	ABC			M		T		
Cleveland Insulated Wire Co. Cleveland, Ohio	D			M				
Coast Cable Co., Los Angeles, Cal.	B							
Collyer Insulated Wire Co. Pawtucket, R. I.	ABCD			Q				
Colonial Wire & Cable Co., Locust Valley, New York	B							X
Columbia Cable & Electric Corp. Brooklyn, N. Y.	B							
Continental Copper & Steel Ind., Inc. Total								
Hatfield Wire & Cable Div. Hillside, N. J.	AB							

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
National Wire Corp., Union, N. J.								
Continental Wire Corp. Wallingford, Conn.	B	G		Q	S			X
Copperweld Steel Co. Total				MQ		TU		
Copperweld Steel Co., Glassport, Pa.						T		
Flexo Wire Co., Inc. Oswego, N. Y.				MQ		TU		
Cornish Wire Co., Inc. Williamstown, Mass.	AB	HI		M	S	TU		
Corona Insulated Wire Co., Brooklyn, N. Y.	A							
Crescent Co., Pawtucket, R. I.	AB					TU	W.	
Crescent Insulated Wire & Cable Co., Trenton, N. J.	ABC							

[fol. 6595]

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Dielectric Materials Co., Chicago, Illinois	B			Q	S			X
Eastern Insulated Wire Corp. Wallingford, Conn.	ABD							
Electric Auto-Lite Co., Toledo, Ohio	BC		JL	Q		TU		
Electric Parts Corp., Chicago, Illinois	B				S			X
Essex Wire Corp., Ft. Wayne, Ind. Total	ABC	I	JKL	Q		TU	VW	
Carolina Industrial Plastics Corp., Mt. Airy, N. C.	B							

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Cuthman, Edwin I., Co., Chicago, Ill.			L					
Diamond Wire & Cable Co. Sycamore, Ill.	AB	I						
Paranite Wire & Cable Co. Tiffin, Ohio						TU		
Paranite Wire & Cable Co. North Birmingham, Ala.							VW	
Essex Wire Corp., Ft. Wayne, Ind.	AB		J					
Essex Wire Corp., Detroit, Mich.			JKL					
Essex Wire Corp., Anaheim, Calif.	ABC		JL	Q		TU		
Etteo Wire & Cable Corp. Brooklyn, N. Y.	B		JKL				VW	
	B							
Gavitt Mfg. Co., Brookfield, Mass.	AB			Q				

[fol. 6596]

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
General Cable Corp., New York, N. Y. Total	ABCDEF	GHI	JKL	MN PQ	S	TU	VW	X
General Cable Corp. Bayonne, N. J.	CDEF	I		P				
General Cable Corp. Emeryville, Cal.	BCE	GI						
General Cable Corp. Los Angeles, Cal.	A							
General Cable Corp. Perth Amboy, N. J.							VW	X
General Cable Corp. Rome, N. Y.	ABF	GHI		NPQ	S	TU		X
	AB		JKL			TU		

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
General Cable Corp.								
St. Louis, Mo.	ABE		JKL				VW	
General Cable Corp.								
Monticello, Ill.		G						
General Cable Corp.								
Tampa, Fla.	AB	G						
Alphaduct Wire & Cable Co.								
New Brunswick, N. J.	AB							
General Insulated Wire Works								
Providence, R. I.	AB	I		M				
Clifton Conduit Co.								
Memphis, Tenn.	B							
Clifton Conduit Co.								
Baltimore, Md.	B							
New England Cable Co.								
Concord, N. H.	AD							

[fol. 6597]

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
General Electric Co.,								
Schenectady, N. Y. Total	ABCDEF		JKL	PQ				X
Bridgeport, Conn.	ABCDEF			P				X
Lowell, Mass.	ABD		JKL	PQ				
Oakland, Calif.	B		JL					
Schenectady, N. Y.			JKL					
Pittsfield, Mass.			JKL					
Hickory, N. C.			J					
Ft. Wayne, Ind.			JKL					X
Rome, Ga.			JL					
General Motors Corp.								
Packard Elec. Div.								
Warren, Ohio	AB		JL	Q				

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Goodline Corp.								
Don Good, Inc., Alhambra, Cal.	B							
Good-Lite Elec. Mfg. Co.								
Bridgeport, Conn.	B							
Gordon, Claud S., Co.								
Richmond, Ill.	D							
Guthman, Edwin I. Co.								
Chicago, Ill. (See Essex Wire)								
Harden, Frank S. Co.								
McConnellsville, N. Y.				M				
Hi-Temp Wires, Inc.								
Mineola, N. Y.			J	Q	S			
Holyoke Wire & Cable Corp.								
Holyoke, Mass.	B							
Hudson Wire Co. Total			JL					
Winsted Div., Winsted, Conn.			JL					
Cassopolis, Mich.			J					
Imperial Wire Co., Inc.								
New Haven, Ind.			J					
[fol. 6598]								
International Tel. & Tel.								
Federal Tel. & Radio Corp.								
Clifton, N. J.	B				S			
International Wire Prod. Corp.								
Midland Park, N. J.				MN		U		X
Jersey Specialty Co.								
Mountainview, N. J.								X
Jordan Wire & Cable Co.								
Jordan, N. Y.						TU		
Judd Wire Mfg. Co.								
Turner's Falls, Mass.	B	I				TU		
Kellogg Switchboard & Supply Co.								
Chicago, Ill.			J					
Kennecott Wire & Cable Co.								
Phillipsdale, Rumford, R. I.	CE	G	JKL			TU	VW	
Kerite Co., Seymour, Conn.	AB							

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Kerrigan-Lewis Mfg. Co., Chicago, Ill.			L					
Laribee Wire & Equip. Corp. Camden, N. Y.						TU		
Lens Electric Mfg. Co. Chicago, Ill.	B	HI			S			X
Lewis Engineering Co. Naughatuck, Conn.	BD			Q				X
Magnet Wire Co. Chicago, Ill.			J					
Miller Electric Co., Pawtucket, R. I.	BD							
Montrose Products Co. Worcester, Mass.	B							
[fol. 6599]								
Narragansett Wire Co. Pawtucket, R. I.	AB					TU		
National Electric Coil Co. Columbus, Ohio			KL					
National Electric Products Corp., Ambridge, Pa.	ABCD			P				
National Standard Co., Niles, Mich.								X
National Tinsel Mfg. Co. Manitowoc, Wisc.								X
Nesor Alloy Product Co. Newark 2, N. J.						T		
New England Cable Co., Concord, N. H. (See Gen. Cable)								
New England Electric Works, Inc. Lisbon, N. H.			L			U		
Nomotuck Mfg. Co., Holyoke, Mass.						TU		X
Northern Engineering and Designing Co., Cicero, Ill.						T		
Okonite Co., Passaic, N. J. Total	ABCEF	I		MOPR	S			
Plant #1, Passaic, N. J.	ABCF			P	S			

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Plant #2, Paterson, N. J.	ABEF	I		MO				
Plant #3, Wilkes-Barre, Pa.	AB							
Overlakes Corp. Total								
Garfield Wire Div.								
Garfield, N. J.								
Lowell Insulated Wire Corp.								
Lowell, Mass.	AB	I		M				
Paragon Wire & Cable Corp.								
Buffalo, N. Y.	AB	H			S			
Phalo Plastics Corp.								
Worcester, Mass.	B			M				
[fol. 6600]								
Phelps Dodge Copper Prod. Total	ABCDEF	GI	JKL	MP	S	TU	VW	X
American Copper Prod. Div.								
Bayway, N. J.						TU	VW	
Habirshaw Cable & Wire Co.								
Yonkers, N. Y.	ABCDEF	GI		MP	S			X
Inca Mfg. Div., Ft. Wayne, Ind.			JKL					
Indiana Rod & Wire Div.								
Ft. Wayne, Ind.							VW	
Philadelphia Insulated Wire Co.								
Philadelphia, Pa.	AB		JL					
Plastic Wire & Cable Corp.								
Jewett City, Conn.	B	I		M		T		
Plastoid Corp., Hamburg, N. J.	B	I		MPQ	S	T		
Radio Wire Mfg. Corp.								
New Augusta, Ind.			L					
Radix Wire Co., Cleveland, Ohio	BCD							
Rea Magnet Wire Co., Inc.								
Ft. Wayne, Ind.			JL					
Rego Electric Co., Hoboken, N. J.	B							
Revere Corp. of America								
Wallingford, Conn.	B					U		
Rex Corp., West Acton, Mass.	B	I						
Rhode Island Insulated Wire Co.								
Cranston, R. I.	ABD							

List of Companies and Plants Producing Copper Wire and Cabl

Rhode Island Insulated Wire Co. Cranston, R. I.	ABD							

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Roebling's, John A. Sons Co. Total	ABCE	GI	JKL			TU		
Insulated Wire & Cable Plant Trenton, N. J.	ABCE	GI	JKL					
Kinkora Works, Roebling, N. J.						TU		
Rockbestos Products Corp., New Haven, Conn.	BCD		L	PQ	S			
Rome Cable Corp., Rome, N. Y.	AB		KL	N		TU	VW	

[fol. 6601]

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Royal Electric Co., Inc. Pawtucket, R. I.	ABD							
Runzel Cord and Wire Co. Chicago, Illinois	AB	H		Q				
Sequoia Process Corp. Redwood City, Calif.	B	I		Q		TU		
Service Steel Prod. Co. Williamsport, Pa.				M				
Simplex Wire & Cable Corp. Total	ABCEF			N				X
Cambridge, Mass.	ABCEF			N				X
Newington, N. H.	F							
Slepian, Arthur & Co. Bridgeport, Conn.			L					
Southern Electrical Corp. Chattanooga, Tenn.	AB					TU		
Southwire Co. Carrollton, Ga.	AB							
Spargo Wire Co., Rome, N. Y.						TU		
Sprague Electric Co. Bennington, Vt.			J			T		
Springfield Wire & Tinsel Co. Springfield, Mass.								X
Standard Wire Co., Cranston, R. I.	D							

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Starring & Co., Inc. Bridgeport, Conn.			J					
State Wire & Cable Corp. Coxsackie, N. Y.	B	I		MPQ	S		VW	
Stromberg Carlson Tel. Mfg. Co. Rochester, N. Y.		H						X
[fol. 6602]								
Suflex Corp., Woodside, N. Y. Total	B							
Electra Insulation Corp. Woodside, N. Y.	B							
Suflex Corp., Woodside, N. Y.	B							
Superior Cable Corp. Hickory, N. C.		I						
Suprenant Mfg. Co. Clinton, Mass.	B	I		Q	S			
Sweeco Wire Co. Wihsted, Conn.			J					
Tensolite Insulated Wire Co. Tarrytown, N. Y.	B		J	Q				
Tevco Insulated Wire Burbank, Calif.	B							
Texas Wire & Cable Co. Plane, Texas	B						VW	
Thermo Electric Co. Saddle Brook, N. J.	BD							X
Times Wire & Cable Co. Wallingford, Conn.	B			Q	S			X
Triangle Conduit & Cable Co. New Brunswick, N. J.	ABC					TU		
Trio Wire & Cable Corp. Brooklyn, N. Y.	B							
Union Plastics Corp. Secaucus, N. Y.	B			Q				
United States Rubber Co. Bristol, R. I.	AB			MNO			W	

List of Companies and Plants Producing Copper Wire and Cable

Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
United States Steel Corp. Amer. Steel & Wire Div. Worcester, Mass.	ABCDEF		JKL	P		T	VW	
U. S. Wire & Cable Co. Union, N. J.	B			M	S			
Up State Wire Co. Williamstown, N. Y.						T		
Utica Wire Corp., Derby, Conn.						T		

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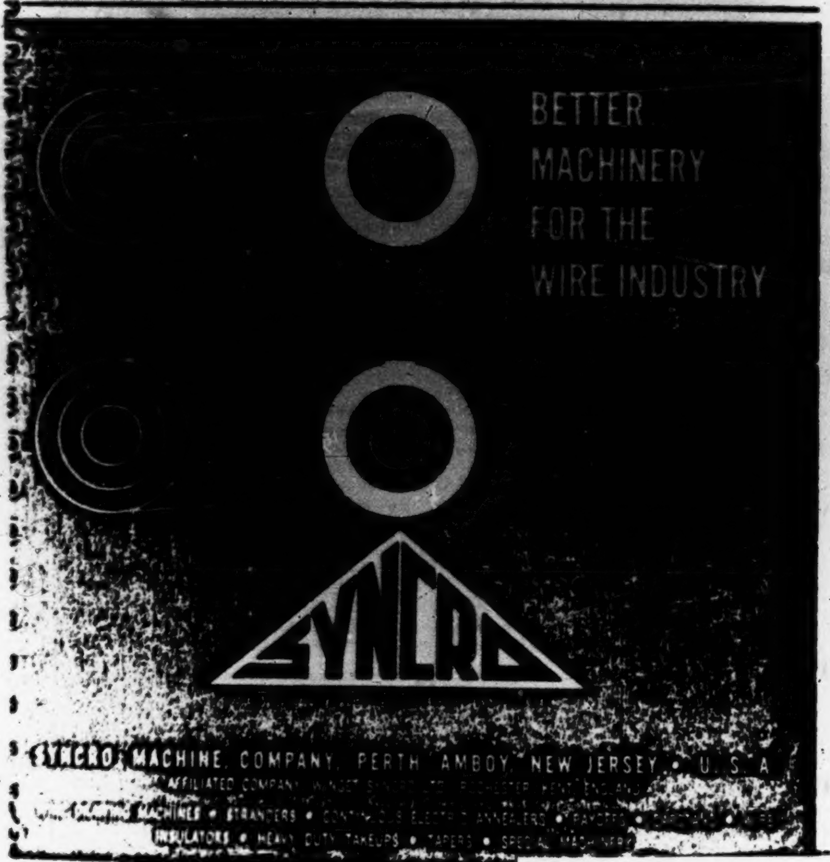
Company and Plant	Insulated Electrical Wire and Cable	Telephone Cables	Magnet Wire	Special Military Items	Coaxial	Tinned and lead alloy coated wire	Weather-proof (textile covered)	Other
Vector Mfg. Co. Houston, Texas	AB							X
Victor Electric Wire & Cable West Warwich, R. I.	B	I		Q	S			
Viking Wire Co. Danbury, Conn.			J					
Walker Bros., Conshohocken, Pa.	AB			P				
Warren Wire Co., Pownal, Vt.	D		JL	Q		TU		
Western Electric Co. Total	AB	GHI	J			T		X
Point Breeze Works, Balto., Md.	AB	GI						
Kearny Works, Kearny, N. J.		GI						
Hawthorne Works, Chicago, Ill.		GI						
Tonawanda Plant, Buffalo, N. Y.		HI	J			T		X
Western Insulated Wire Co. Los Angeles, Calif.	AD							
Westinghouse Electric Corp. Cheektowaga, N. Y.			JKL					
Wheeler Insulated Wire Co., Inc. Waterbury, Conn.			JL					
Whitaker Cable Corp. North Kansas City, Mo.	B							
Whitney-Blake Co., Hamden, Conn.	AB	I		M				

USCOMM—DC—

DEFENDANTS' EXHIBIT 73


WIRE 1961 EDITION

AND WIRE PRODUCTS

BUYERS' GUIDE

AND YEARBOOK OF THE WIRE ASSOCIATION

INTRODUCTION

THE annual WIRE AND WIRE PRODUCTS BUYERS' GUIDE AND YEAR BOOK OF THE WIRE ASSOCIATION, of which this is the thirty fourth edition, aims to present complete and comprehensive lists of manufacturers of bare and covered wire, of fabricators of wire, and of supplies and equipment used by both.

This edition has been greatly improved and has combined with it the thirtieth YEAR BOOK OF THE WIRE ASSOCIATION.

Lists were made up as the result of direct circularization of the industries represented. As in any annual reference work, a certain percentage of errors and omissions are unavoidable, but every effort has been made to keep these down to a negligible minimum up to the time of going to press.

In this connection, users of the book are asked to remember the willingness of the publishers to supplement the information contained in this directory with prompt acknowledgment of any inquiries for information about sources of supply for wire, wire products, and the machinery, supplies and equipment entailed in their manufacture.

The BUYERS' GUIDE is not only a guide to products and manufacturers but also a subject matter index to the 1960 volume of WIRE AND WIRE PRODUCTS, the only publication serving this industry.

In communicating with any firm herein listed you will confer a favor on both the publisher and manufacturer by referring to the fact that the name or information was found in this BUYERS' GUIDE.

The price of the Buyers' Guide is $5.00 per copy. Subscribers to WIRE AND WIRE PRODUCTS receive a 40% discount. Members of THE WIRE ASSOCIATION receive a copy without additional cost.

The Publishers.

WIRE AND WIRE PRODUCTS

488 Main Street Stamford, Conn.

A monthly publication devoted to the interests of rod, wire and strip mills, insulated wire and cable manufacturers, wire formers and fabricators and manufacturers of wire mill equipment.

DESIGNATED AS "OFFICIAL PUBLICATION" BY THE WIRE ASSOCIATION

Issued Monthly

75 Cents a Copy in U. S.	Per year, United States, $8.00
75 Cents a Copy in Canada	Per year, Canada, $8.00
90 Cents a Copy in Foreign Countries	Per year, Foreign, $10.50

October Convention Issue $1.25 a Copy

January Convention Proceedings Issue $1.25 a Copy

WIRE—Drop Wires, Steel (Automatic Loom Stop Motion)

BEKAERT STEEL WIRE CORP., 666 Madison Ave., New York 21, N. Y.

MOSSBERG PRESSED STEEL CORP., Attleboro.

WICKWIRE SPENCER STEEL DIV., COLORADO FUEL & IRON CORP., 575 Madison Ave., N. Y. 22, N. Y.

WIRE—Electrical Measuring Instrument

Driver-Harris Co., Harrison, N. J.

Driver, Wilbur B., Co., 1875 McCarter Highway, Newark 4, N. J.

WIRE—Electrical (Aluminum)

ALABAMA WIRE CO., INC., P. O. Box 648, Florence, Ala.

Hudson Wire Co., 62 Water St., Ossining, N. Y.

WIRE: ELECTRIC WIRE AND CABLE

A list of plants producing insulated Electric Wire and Cable. For bare electric wires, such as Battery Cable, ACSR, Resistance, Exterior Telephone, Trolley, Tinsel, etc., look under appropriate wire headings for names of manufacturers. Letter and number symbols are used below to indicate the general categories under which the insulated wires are classified.

	POWER CABLES	J	Service Entrance		**MISCELLANEOUS**
A	Armored	K	Sign	U	Automotive & Aircraft
B	High Tension	L	Slow Burning	V	Ignition
C	Low Voltage	M	Telephone & Signal	W	Control
D	Buried	N	Thermocouple Lead-in	X	Resistance (insul.)
		O	Weatherproof	Y	Instrument
	CODE & CORD WIRES		**MAGNET WIRES**	Z	Submarine
E	Building	P	Enameled	1	Shipboard
F	Fixture	Q	Synthetic Coated	2	Radio & TV Hook-up
G	Heater	R	High Temperature	3	Coaxial
H	Lamp	S	Litz	4	Geophysical
I	Portable Power	T	Textile Covered		

AC Spark Plug Div., General Motors Corp., Flint, Mich.	A
Accurate Insulated Wire Corp., 48 Fox St., New Haven 1, Conn.	B C Q 2 3
Ace Wire Mills, Inc., 88 Fifth Ave., Paterson, N. J.	C G H I P W 1
Acme Wire Company, 1255 Dixwell Avenue, New Haven 14, Conn.	P R
Acorn Insulated Wire Co., Div. of Amer. Insulated Wire Corp., 30 Freeman St., Pawtucket, R. I.	C F G H I V 2
Advance Insulated Wire & Cable Co., 216 Tingley Lane, Metuchen, N. J.	C F G H I
Aero-Tech Products Co., 260 Main St., Chatham, N. J.	C F G J M N O P U V Y 1 2 3
Aircraft, Marine, Communication Wire Industries, Inc., 112th St., Gr. Northern Blvd., East Elmhurst 69, N. Y.	F M N T U V 2 3
A-K Mfg. Co., Inc., 115 S. Northwest Highway, Barrington, Ill.	Y 2 3
Alfred Covered Wire Co., 512 Broadway, New York, N. Y.	F G H 2
Alpha Wire Corp., Div. of Laurel Electronics Corp., 200 Varick St., New York 14, N. Y.	H I P U Y 2
Alphadust Wire & Cable Co., 25 Van Dyke Ave., New Brunswick, N. J.	M Y
Aluminum Co. of America, Alcoa Bldg., Pittsburgh 19, Pa.	O

American Electric Cable Co., 181 Appleton Street, Holyoke, Mass.	A B C F G H M N U V 2 3
American Electric Heater Co., 6110 Cass Ave., Detroit 2, Mich.	G
American Flexible Conduit Co., Inc., 929 Shawmut Ave., New Bedford, Mass.	A
American Insulated Wire Corp., 36 Freeman St., Pawtucket, R. I.	B C F G H I J L O V W 2 3
American Leonie Mfg. Co., Westinghouse Bldg., 2001 Walnut St., Philadelphia 4, Pa.	X
American Metal Molding Co., 146 Colt St., Irvington, N. J.	A C E
American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio.	A B C D E I J L M N O P T Z 1 3 4
American Super-Temperature Wires, Inc., Sub. of Haveg Industries, Inc., 112 W. Canal St., Winooski, Vt.	P U V Y Z 1 2 3
Ampere Wire & Cable Corp., 4 Dashford Ave., Yonkers, N. Y.	A B C O
Amperex Electronic Corp., 230 Duffy Ave., Hicksville, L. I., N. Y.	N
Amphenol Cable & Wire Div., Amphenol-Borg Electronics Corp., 1830 S. 54th Ave., Chicago, Cicero 50, Ill.	U Y Z 1 2 3
Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.	A B C D E F I J M O P T U V Y Z 1 2 3 4
Anchor Plastics Co., 36-36 36th St., Long Island City 6, N. Y.	1
Andrew Corp., 363 E. 75 St., Chicago 19, Ill.	2 3
Ansonia Wire & Cable Co., 111 Martin St., Ashton, R. I.	A C D N Z 1 2 3
Apex Wire & Cable Corp., 257 37th St., Brooklyn 32, N. Y.	F G H I U 2
Arens Controls, Inc., 2017 Greenleaf St., Evanston, Ill.	F G H
Arco Wire & Cable Co., 1100 Stratford Rd., Stratford, Conn.	P Q S
Atlantic Wire & Cable Co., 110-14 14th Rd., College Point, N. Y.	E F H I K M N O U V 1 2 3 4
Auburn Plastics, Inc., 63 Canoga Rd., Auburn, N. Y.	F H
Austin Wire & Cable Co., 625 W. Jackson Blvd., Chicago, Ill.	B E F J Y 2 3 4
Belden Mfg. Company, 415 So. Kilpatrick Ave., Chicago 44, Ill.	B C I K P S T U V Y 2 3 4
Bell Telephone Laboratories, Murray Hill, N. J.	M
Berkshire Electric Cable Co., Leeds, Mass.	U V Y 2 3 4
Boston Ins. Wire & Cable Co., 65 Bay Street, Dorchester 25, Mass.	U V Y 1 2 3 4
Bradford, Kyle & Co., Box 28, Plymouth, Mass.	S T

William Brand — Rex Div., American Enka Corp., Willimantic, Conn.	MY1234
William Brand — Rex Div., American Enka Corp., Hayward Rd., W. Acton, Mass.	CFGHINRU2
Bridgeport Enamel Wire Co., 514 Surf Ave., Stratford, Conn.	PQT
Bridgeport Insulated Wire Co., 51 Brookfield Ave., Bridgeport 10, Conn.	PST
Bryant Wire & Cable Co., 319 S. Hamilton St., High Point, N. C.	
C & W Insulated Wire Co., 1626 Stoop Ave., Fort Wayne, Ind.	Q
Cable Wire Co., 300 King St., Littleton, Mass.	FH
Calcon Mfg. Co., 300 Oakland Ave., Washington, Pa.	FHOUV23
Carol Cable Co., Div., The Crescent Co., 300 Middle St., Pawtucket, R. I.	CFGHIUV
Carolina Industrial Plastics Div., Essex Wire Corp., Mt. Airy, North Carolina.	GV23
Chase Products Corp., 813 Hancock Ave., Bridgeport, Conn.	FGPQX
Chasco Mfg. Co., Franklin & Poplar Sts., Dowagiac, Mich.	FH
Central Cable Corp., 600 Washington Ave., Jersey Shore, Pa.	CDO
Champion Wire & Cable Co., 165 Central Ave., Rochelle Park, N. J.	ABCGN
Champlast, Inc., 5 Central Ave., E. Newark, N. J.	UVWZ13
Chester Cable Corp., Sub. of Tennessee Corp., Chester, N. Y.	EFHKMOUVY1234
Chicago Magnet Wire, Inc., Sub. of Advance Transformer Co., 345 No. Francisco Ave., Chicago 18, Ill.	P
Cimco Wire & Cable Co., 555 W. Crescent Ave., Allendale, N. J.	C24
Circle Wire & Cable Corp., Sub. of Cerro Corp., 5500 Maspeth Ave., Maspeth, L. I., N. Y.	ABCDEFHIJO1
Clark Cable Corp., 3104 W. 32nd St., Cleveland, Ohio.	VW12
Clarostat Mfg. Co., Inc., Dover, N. H.	GX
Cleveland Insulated Wire Co., 15201 Chatfield St., Cleveland, Ohio.	CFGHI
Clifton Conduit Co., 2300 Eastbourne Ave., Baltimore 24, Md.	BCFHIPQ
Coast Cable, Inc., 2215 Exposition Place, Los Angeles 18, Calif.	CFHI
Collyer Insulated Wire Co., 249 Roosevelt Ave., Pawtucket, R. I.	ABCDEFIJMOW1
Colonial Wire & Cable Co., 400 Forest Ave., Locust Valley, N. Y.	EFJMY23
Columbia Cable & Elec. Co., 255 Chestnut St., Brooklyn 8, N. Y.	AEJ
Commercial Cord Co., Inc., 26 E. Main St., Clifton Springs, N. Y.	EFGHIM

Connecticut Cord & Cable Co., P. O. Box 185, Guilford, Conn.	M U V W Y 2 3
Conndr, H. R., Electrical Insulations, Inc., 1920 N. James St., Rome, N. Y.	T U Y 2
Continental Wire Corp., 380 Maryland Ave., York, Pa.	C F K
Continental Wire Corp. of Conn., 322 No. Cherry St., Wallingford 2, Conn.	W Y 2 3 4
Cordomatic Div., Vacuum Cleaner Corp. of Amer., 1726 W. Indiana Ave., Philadelphia, Pa.	I
Cornish Wire Co., Div. of General Cable Corp., 101 Water St., Williamstown, Mass.	F G H I K M T U V Y 2 3 4
Corona Insulated Wire Co., 759 E. 43rd St., Brooklyn 16, N. Y.	F G H I
Cox & Company, Inc., 115 E. 23rd St., New York 10, N. Y.	N
Crescent Co., The 20 Central Ave., Pawtucket, R. I.	C F G H I O V W 3
Crescent Insul. Wire & Cable Co., N. Olden Ave., & Taylor St., Trenton 5, N. J.	A B C D E F H I J 1
Custom Systems Corp., 2000 W. Delhi Rd., Santa Ana, Calif.	A B C Y 3
Diamond Wire & Cable Co., 405 Park Ave., Sycamore, Ill.	A E F G H I J K M O
Dielectric Materials Co., 5315 No. Ravenswood Ave., Chicago 40, Ill.	B C E F L M T U Y 2 3 4
Dover Wire Co., 1 Trenton Ave., Clifton, N. J.	
Driver-Harris Company, Middlesex St., Harrison, N. J.	N X
Driver, Wilbur B., Co., 1875 McCarter Highway, Newark 4, N. J.	X Y
du Pont, E. I., de Nemours & Co., Pompton Lakes, N. J.	I
Eastern Insulated Wire Corp., Div. of Circle F Mfg. Co., No. Cherry St., Wallingford, Conn.	E F H I
Electra Insulation Corp., 32-18 57th St., Woodside 77, N. Y.	C F H I T 2
Electric Autolite Co., Wire & Instrument Div., P. O. Box 931, Toledo 1, Ohio.	E F H I P Q T U V 2
Electric Parts Corp., P. O. Box 324, Georgetown, Ky.	I 2
Electro Wire Corp., Box 979, Danbury, Conn.	P
Electronic Prod. & Devel., 130 Nevada St., El Segundo, Calif.	
Empire Wire & Cable Co., Penn Yan, N. Y.	C E F G H
Engineered Wire & Cable, Inc., No. Main St., Winsted, Conn.	A C I M N Y 4
Essex Wire Corp., 1601 Wall St., Fort Wayne 6, Ind.	A through P, R through 4
Essex Wire Corp., Paranite Wire & Cable Div., 6200 Concord, Detroit 2, Mich.	A C I P Q T V 2
Essex Wire Corp. of Calif., P. O. Box 30, Anaheim, Calif.	A through K, M O P T U V 2 4

Ethco Wire & Cable Corp., 75 Onderdonk Ave., Brooklyn 27, N. Y.	A C E F J
Gavitt Wire & Cable Co., Div. of Amerace Corp., Brookfield, Mass.	F M N U Y 2 3
General Cable Corp., 420 Lexington Ave., New York 17, N. Y.	A through 4
General Electric Co., 1285 Boston Ave., Bridgeport 2, Conn.	A B C D F G H I J K N O P S T U Y Z 1 2 3
General Electric Co., Motor & Generator Div., 1 River Rd., Schenectady 5, N. Y.	P Q T
General Insulated Wire Works, Div. of General Cable Corp., 69 Gordon Ave., Providence 5, R. I.	F G H I K M 2 3
General Wire Products Co., 6 Hygeia St., Worcester 8, Mass.	C E F H M T U V Y 2 3
Good-Lite Elec. Mfg. Co., 1485 Seaview Ave., Bridgeport, Conn.	F G H I
Gordon, Claud S., Co., McHenry Co., Richmond, Ill.	A B C G N
Gore, W. L., & Associates, Inc., 555 Papermill Rd., Newark, Del.	M O R U Y 3
Guthman Div., Essex Wire Corp., 2801 West Addison, Chicago, Ill.	F H I P Q T 2
Habirshaw Cable & Wire Corp., Div. Phelps Dodge Copper Prods. Corp., Yonkers, N. Y.	A through M, O W 1 2 3
Harco Laboratories, Inc., Harco Div., 77 Olive St., New Haven, Conn.	N
Hatfield Wire & Cable Div., Continental Copper & Steel Industries, Inc., 487 Hillside Ave., Hillside, N. J.	A B C F G H I V W 1 2
Haveg Industries, Inc., Halocarbon Div., 900 Greenbank Rd., Wilmington 8, Del.	C F H I 2 3
Hazard Insulated Wire Wks., Div. of Okonite Company, Sub. of Kennecott Copper Corp., Box 67, No. Brunswick, N. J.	A C D E F H I W 1
Hendrix Wire & Cable Corp., Milford, N. H.	B C O
Hitemp Wires, Inc., Div., Simplex Wire & Cable Co., 1200 Shames Drive, Westbury, L. I., N. Y.	C G P Q R U 2 3
Holyoke Wire & Cable Corp., 720 Main St., Holyoke, Mass.	F M T Y 2 3
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit 8, Mich.	N X Y
Hudson Wire Co., Magnet Wire Div., 62 Water St., Ossining, N. Y.	P Q R S T
Ideal Wire Products, Inc., 876 Lawrence St., Lowell, Mass.	
Industrial Pyrometer & Supply Co., 2017 Holland St., Alton, Ill.	L N O Y
Inso Electronic Products, Inc., Sub. of Adam Consol. Industries, Inc., 1200 Commerce Ave., Union, N. J.	Y 2 3 4

International Standard Electric Corp., 67 Broad St., New York 4, N. Y.	B C
Jefferson Wire & Cable Corp., Pleasant Valley Rd., Sutton, Mass.	F K M U 2 3
Jelliff, C. O., Mfg. Corp., Southport, Conn.	X
Jemco Insulated Wire Co., 117 Republic Ave., Joliet, Ill.	F H I M 2
Jersey Specialty Co., Inc., Burgess Pl., Wayne, N. J.	F H 2
Johnson, E. F. Co., Waseca, Minn.	P 3
J P M Co., Lewisburg, Pa.	
Jordan Rogers Co., 200 So. Cypress St., Orange, Calif.	E F O
Judd Wire Mfg. Co., Turner's Falls, Mass.	C I K M U V Y 2 3
Kaiser Aluminum & Chemical Corp., P. O. Box 671, Newark, Ohio	C V
Kaiser Aluminum & Chemical Corp., Electrical Conductor Div., Bristol, R. I.	A B C D E I J K M O Y Z 1 3 4
Kellogg Switchboard & Supply Co., 6650 So. Cicero Ave., Chicago 38, Illinois	A B C D E F H I O
Kennecott Wire & Cable Co., Phillipsdale, Rumford 16, R. I.	C P Q T
Kerite Co., 49 Day St., Seymour, Conn.	A B C D I Z
Kerrigan-Lewis Mfg. Co., 4421 W. Rice St., Chicago 51, Ill.	S T
Lenhart Mfg. Co., Hamburg, Pa.	V
Lenz Electric Mfg. Co., 1751 N. Western Ave., Chicago 47, Ill.	C M Y 2 3
Lewis Engineering Co., No. Spring St., Naugatuck, Conn.	C F N U 3
Liberty Copper & Wire Co., 4045 W. Kinzie St., Chicago 24, Ill.	P S
Malin & Co., The, 3824 Vestry Ave., Cleveland 13, Ohio.	Y
Microdot, Inc., Cable Div., 220 Pasadena Ave., South Pasadena, Calif.	M U Y 2 3
Miller Electric Co., 120 Main St., Pawtucket, R. I.	F G H I T
Miller, L. C., Co., 6065 E. Slauson Ave., Los Angeles 22, Calif.	3
Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa.	N
Mohawk Wire & Cable Co., 45 Summer St., Leominster, Mass.	M Y 2 3
Molecu Wire Corp., Eatontown, Freehold Pike, Scobeyville, N. J.	P Q R T
Montrose Products Co., Auburn Industrial Park, Auburn, Mass.	F Y 2 3
Mosler Research Products, Inc., 220 Fifth Ave., New York 1, N. Y.	C
Narragansett Wire Co., 1160 Main St., Pawtucket, R. I.	B C D E I J M O W Z

National Electric Coil Co., 800 King St., Columbus 16, Ohio.	T
National Electric Div., H. K. Porter Co., 300-16th St., Ambridge, Pa.	A B C D E F I J M W Z 1
National Wire & Cable Corp., 130 San Fernando Rd., Los Angeles 31, Calif.	W Y
Nehring Electrical Works, DeKalb, Illinois.	A B C E T
Neier Alloy Products Co., 600 Passaic Ave., West Caldwell, N. J.	G M U V Y Z 1 4
New England Cable Co., 22 Bridge St., Concord, N. H.	F G H I U Y 2
New England Elec. Wks., Sub. of The Montgomery Co., 365 Main St., Lisbon 1, N. H.	P Q R S T U Y
New Haven Wire & Cable Co., Box 122, New Haven, Ind.	P
Ohm Wire & Cable Corp., 221 Liberty Ave., Brooklyn 8, N. Y.	F H U X
Okonite Company, The Sub. of Kennecott Copper Corp., Canal St., Passaic, N. J.	A B C D E I J N O P T W Z 1 3
Organic Development Corp., 10002 Larson Ave., Garden Grove, Calif.	M N O P U Y 2 3
Pacific Automation Products, Inc., 1200 Airway, Glendale, Calif.	A B C O Y Z 1 3
Packard Electric Div., General Motors Corp., Warren, Ohio.	B C E F G H I K M O P T U V 2 3 4
Paragon Electric Co., Two Rivers, Wisconsin.	F H I
Paragon Wire & Cable Corp., 221 E. Genesee St., Buffalo 3, N. Y.	F H K M U Y 2 3
Paranite Wire & Cable Div., Essex Wire Corp., Marion, Ind.	F H I
Parkside Wire Co., 2535 W. Armitage Ave., Chicago 47, Ill.	I U
Permaluster, Inc., 2012 Burbank Blvd., Burbank, Calif.	R U Y
Phalo Plastics Corp., 530 Boston Turnpike, Shrewsbury, Mass.	E F H I M Y 2 3
Phelps Dodge Copper Prods. Corp., 300 Park Ave., N. Y. 22, N. Y.	A through M, O W 1 2 3
Philadelphia Insul. Wire Co., 232 New Albany Rd., Moorestown, N. J.	C M N U Y 2 3 4
Plastic Wire & Cable Corp., Jewett City, Conn.	C E F H I K M O U V Y 2 3
Plastoid Corp., Hamburg, N. J.	M U Y 1 2 3
Plated Wires & Electronics, Inc., 60 Main St., Ansonia, Conn.	P
Precision Tube Co., Inc., Church Rd. & Wissahickon Ave., No. Wales, Pa.	3
Pyrometer Corp. of Amer., Inc., 600 E. Lincoln H'way, Penndel, Pa.	C N P
Radio Wire Mfg. Corp., New Augusta, Ind.	T 2
Radix Wire Co., The 26260 Lakeland Blvd., Cleveland 23, Ohio.	C E F G N U V 2

Raychem Corp., Oakside at Northside, Redwood City, Calif.	R U 3
Rea Magnet Wire Co., Inc., Div. of Aluminum Co. of Amer., 3601 E. Pontiac Rd., Ft. Wayne, Ind.	P Q R T
Rego Insulated Wire Co., 830 Monroe St., Hoboken, N. J.	F H I M U W 2 3
Revere Corp. of America, North Colony Rd., Wallingford, Conn.	U V Y Z
Reynolds Metals Co., 6601 W. Broad St., Richmond 18, Va.	B C E F L V
Richards, Arkley S., Co., Inc., 115 Winchester St., Newton Highlands 61, Mass.	N
Rockbestos Wire & Cable Co., Div. of Cerro Corp., 285 Nicoll St., New Haven 4, Conn.	A C F N U 1 2 3
Rockland Insulated Wire & Cable Co., 36 Main St., Haverstraw, N. Y.	U Y 2 4
Rocky Mount Cord Co., 410 Gay St., Rocky Mount, N. C.	
Roebling's, John A., Sons Div., The Colorado Fuel & Iron Corp., 640 So. Broad St., Trenton 2, N. J.	A B C D E H I J L M O P Q R T W Z 1
Roesch, Douglas, Cable Div., Hall-Scott, Inc., 2800 N. Ontario St., Burbank, Calif.	N W 1 2 3
Rome Cable Div., Aluminum Co. of Amer., Rome, N. Y.	A B C E F H I J M O P T U Y Z 1 2
Ross Mfg. Co., 800 Washington St., Burlington, Iowa.	U
Royal Electric Corp., 95 Grand Ave., Pawtucket, R. I.	A B C F G H I O V W 1 2 3 4
Russel Cord & Wire Co., 4729 W. Montrose Ave., Chicago 41, Ill.	A C D F H I T 2
Saxton Wire & Cable Div., Saxton Products, Inc., 4320 Park Ave., Bronx 57, New York, N. Y.	P V W 2 3
Saylor Electric Products Corp., 277 Pierce St., Birmingham, Mich.	C F I O
Seal Wire Co., 800 S. Lafayette St., Shelby, N. C.	C O
Secon Metals Corp., 7 Intervale St., White Plains, N. Y.	L N P R U Y
Sequoia Wire & Cable Co., Sub. of Anaconda Wire & Cable Co., 2201 Bay Road, Redwood City, Calif.	F H I R U 2 3
Serwell Products Co., 6541 Euclid Ave., Cleveland 3, Ohio.	C V
Sher-Dan Insulated Wire Co., 170 Imlay St., Brooklyn 31, N. Y.	
Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.	A B C D I Y Z 1 3 4
Siopian, Arthur, & Co., 1180 Stratford Rd., Stratford, Conn.	P Q S
Southern Electrical Co., Div. of Olin Mathieson Chemical Corp., P. O. Box 800, Chattanooga, Tenn.	C J O

Southwire Company, 6 Fertilla St., Carrollton, Ga.	E F J O
Spectra-Strip Wire & Cable Corp., Box 415, Garden Grove, Calif.	M N P R U Y 2 3
Sprague Electric Co., 441 Marshall St., North Adams, Mass.	N P Q R
Springfield Wire & Tinsel Co., 70 Leete St., Springfield, Mass.	F G M Y 2
Standard Wire Co., 725 Branch Ave., Providence, R. I.	F
State Wire & Cable Corp., Coxsackie, N. Y.	C E F H M U
Stromberg-Carlson Co., Div. General Dynamics Corp., 100 Carlson Rd., Rochester 3, N. Y.	F L I O T
Suflex Corp., 33-40 57th St., Woodside 77, N. Y.	C F L I 2
Superior Cable Corp., P. O. Box 480-A, Hickory, N. C.	M Z 2 3
Superior Insulated Wiry Co., Washburn Lane, Stony Point, N. Y.	F H M 2
Surprenant Mfg. Co., 172 Sterling St., Clinton, Mass.	A B C D F G I M N Ó R U V Y Z 1 2 3 4
Sweeney Wire Co., Winsted, Conn.	P
Sylvania Electric Products, Inc., Sub. of General Telephone & Telegraph Co., 1740 Broadway, New York 19, N. Y.	X
Tech Wire Associates, Inc., Commercial Ave., Moonachie, N. J.	C F G H I K M N U V Y Z 1 2 3 4
Tennessee Plastics, Inc., Box 3117, Carroll Reece Branch, Johnson City, Tenn.	X
Tensolite Insulated Wire Co., Sub. of Carlisle Corp., 198 Main St., Tarrytown, N. Y.	N P U Y 3 4
Tevro Insulated Wire 100 E. Prospect Ave., Burbank, Calif.	F H I K U V W 2 3
Texas Wire & Cable Co., Sub. of Narragansett Wire Co., 10th & Texas Sts., Plano, Texas.	E F J O
Thermal Wire of America, Keeler's Bay, So. Hero, Vermont.	P 3
Thermantics, Inc., Elm City, N. C.	U Y 1 2 3
Thermo-Electric Co., 109 Fifth St., Saddle Brook, N. J.	N
Thordarson-Meissner Mfg., Div. Maguire Industries, Inc., Mt. Carmel, Ill.	P Q T
Times Wire & Cable Div., International Silver Co., 358 Hall Ave., Wallingford, Conn.	U Y Z 2 3
Triangle Conduit & Cable Co., Inc., P. O. Box 711, New Brunswick, N. J.	A C D E F J O
Trio Wire & Cable Corp., 208 Mesrole Ave., Brooklyn 22, N. Y.	C F L I
Uniform Tubes, Level Road, Collegeville 2, Pa.	N V 3
U. S. Wire & Cable Corp., Progress Ave., & Monroe Sts., Union, N. J.	E F 2 3

Vector Mfg. Co., 2808 Lawndale, Houston 23, Tex.	Y Z 4
Victor Electric Wire & Cable Co., 618 Main St., W. Warwick, R. I.	F H I U Y 2 3
Viking Wire Co., Shelter Rock Rd., Danbury, Conn.	P
Walther Bros., Conshohocken, Pa.	B C D E F I J O U V
Warren Wire Co., Pownal, Vt.	P U Y 3
Washburn Wire Co., Inc., 211 Waterman St., Phillipsdale, R. I.	A U
Western Electric Co., 195 Broadway, New York 7, N. Y.	A B C D 2 3
Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.	C F G H I M Y 3 4
Westinghouse Electric Corp., Genesee St., Buffalo 25, N. Y.	N Q R
Westwood Cable Corp., 3440 Overland Ave., Los Angeles 34, Calif.	I M N U 1 2 3
Whitaker Cable Corp., 1301 Burlington Ave., Kansas City 16, Mo.	U V Y 2
Whitney Blake Co., The, 1565 Dixwell Ave., New Haven 14, Conn.	F G H I 2
Winsted Division, Hudson Wire Co., Winsted, Conn.	P Q S T Y 2 4
Wire & Cable Co., P. O. Box 861, Maywood, N. J.	•
Wire Company of America, Sub. of Warren Wire Co., 400 David Lane Pl., Goleta, Calif.	U Y
Wirecraft Products, Inc., Route 9, W. Brookfield, Mass.	Y 3 4
Wirekraft, Inc., Rolling Prairie, Ind.	E F G H I K L M O U V Y 1 2
World Wide Wire, Inc., Florida St., Farmingdale, N. Y.	

WIRE—Electronic Shielding

Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Alpha Wire Corp., 200 Varick St., New York 14, N. Y.
BROOKFIELD WIRE CO., Airport, Brookfield, Mass.
FORT WAYNE METALS, INC., [illegible] Dr., Fort Wayne 6, Ind.
Hudson Wire Co., 62 Water St., Ossining, N. Y.
INTERNATIONAL FINE WIRE CO., Greenwood Ave., Midland Park, N. J.
NEW ENGLAND ELECTRICAL WORKS, INC., Sub. of The Montgomery Co., [illegible] Main St., Lisbon 1, N. H.
Riverside-Alloy Metal Div., H. K. Porter Co., Prospect Park, Pa.
Sylvania Electric Products, Inc., Parts Div., Warren, Pa.
TORPEDO WIRE & STRIP, INC., R. D. 2, Pittsfield, Torpedo, Pa.

WIRE—Elevator, Electric Cable

American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio.
Driver-Harris Co., Harrison, N. J.
General Cable Corp., 420 Lexington Ave., New York 17, N. Y.
Hazard Insulated Wire Works, Div. of Okonite Co.
Kaiser Aluminum & Chemical Corp., P. O. Box 671, Newark, Ohio
Wilkes-Barre, Pa.
Knickerbocker Annunciator Co., 75 Murry St., New York, N. Y.
National Electric Prod. Corp., Chamber of Commerce Bldg., Pittsburgh 30, Pa.
Phelps Dodge Copper Products Corp., 300 Park Ave., New York 22, N. Y.
ROEBLING'S, JOHN A., SONS DIV., THE COLORADO FUEL & IRON CORP., 640 So. Broad St., Trenton 2, N. J.
Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.

WIRE—Elevator Hoisting Cables

American Steel & Wire Div., U. S. Steel Corp., Rockefeller Bldg., Cleveland 13, Ohio.
BEKAERT STEEL WIRE WORKS, Zwevegem, Belgium.
BETHLEHEM STEEL CO., Bethlehem, Pa.
Bethlehem Steel Co., Pacific Coast Div., 20th & Illinois Sts., San Francisco 19, Calif.
Broderick & Bascom Rope Co., 4203 No. Union Blvd., St. Louis 15, Mo.
California Wire Cloth Corp., 1080 19th Ave., Oakland 6, Calif.
Columbia-Geneva Steel Div., United States Steel Corp., Equitable Bldg., San Francisco 6, Calif.
Hazard Wire Rope Co., Div. of American Chain & Cable Co., Wilkes-Barre, Pa.
Leschen Wire Rope Div., H. K. Porter, Inc., 5909 Kennerly Ave., St. Louis 12, Mo.
Macwhyte Wire Rope Co., 2903-14th Ave., Kenosha, Wis.

[fol. 6616] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 74

Executive Office of The President
Bureau of The Budget
Percival F. Brundage, Director

Standard Industrial Classification Manual

Prepared by
The Technical Committee on Industrial Classification
Office of Statistical Standards
1957

For sale by the Superintendent of Documents, U.S.
Government Printing Office, Washington 25, D.C.
Price $2.50

[fol. 6617] Introduction

The Standard Industrial Classification

Purpose of the Classification

The Standard Industrial Classification was developed for use in the classification of establishments by type of activity in which engaged; for purposes of facilitating the collection, tabulation, presentation, and analysis of data relating to establishments; and for promoting uniformity and comparability in the presentation of statistical data collected by various agencies of the United States Government, State agencies, trade associations, and private research organizations.

Scope of the Classification

The Classification is intended to cover the entire field of economic activities: agriculture, forestry, and fisheries; mining; construction; manufacturing; transportation, communication, electric, gas, and sanitary services; wholesale and retail trade; finance, insurance, and real estate; services; and government.

This Manual presents a revision of the 1945 edition of Manufacturing Industries and the 1949 edition of Nonmanufacturing Industries. In this revision a number of changes suggested by users of the classification and by consumers of industry data have been incorporated. Among the more important changes in the Classification are: (1) separate Major Groups for commercial and noncommercial farms; (2) the transfer of milk pasteurization plants; ready mixed concrete establishments; and apparel, knitting and leather jobbers or converters from trade to manufacturing; (3) a rearrangement of local transportation companies; (4) the transfer of radio and television broadcasting from services to a new Major Group covering communication facilities; and (5) a more detailed classification of government.

The format of the Manual also represents a change from previous editions. The separate volumes for manufacturing and nonmanufacturing industries have been eliminated by consolidating into a single volume the industry

titles and descriptions, as well as the alphabetic index of principal products, processes, and services.

Principles of the Classification

The Classification was prepared by the Technical Committee on Standard Industrial Classification, assisted by a number of special committees of experts in various fields of business. The work of the Technical Committee was carried on under the sponsorship and general supervision [fol. 6618] of the Office of Statistical Standards of the Bureau of the Budget, Executive Office of the President.

In preparing the Classification, the Technical Committee was guided by the following general principles:

(1) The Classification should conform to the existing structure of American industry.

(2) The reporting units to be classified are establishments, rather than legal entities or companies.

(3) Each establishment is to be classified according to its major activity.

(4) To be recognized as an industry, each group of establishments must have significance from the standpoint of the number of persons employed, volume of business, and other important economic features, such as the number of establishments.[1] The procedure followed as a guide in measuring the economic significance of manufacturing industries is outlined in the Appendix, page 429.

Definition of Establishment

An "establishment" is an economic unit which produces goods or services—for example, a farm, a mine, a factory, a store. In most instances, the establishment is at a single physical location; and it is engaged in only one, or predominately one, type of economic activity for which an industry code is applicable.

Where a single physical location encompasses two or

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[1] An exception to this principle is found in the grouping of establishments into industries described as "not elsewhere classified."

more distinct and separate economic activities for which different industrial classification codes seem applicable, such activities should be treated as separate establishments and classified in separate industries, provided it is determined that: (1) such activities are not ordinarily associated with one another at common physical locations; (2) no one industry description in the Standard Industrial Classification includes such combined activities; (3) the employment in each such economic activity is significant;[2] and (4) reports can be prepared on the number of employees, their wages and salaries, and other establishment type data. An establishment is not necessarily identical with the business concern or firm, which may consist of one or more establishments. Also, it is to be distinguished from organizational subunits, departments, or divisions within an establishment. Supplemental interpretations of the definition of an establishment are included in the industry descriptions of the Standard Industrial Classification.

[fol. 6619] Auxiliary Units

In applying the Standard Industrial Classification to individual establishments, instances will be encountered where the activity of an establishment under consideration may have some, but not all, of the characteristics of individual industries as provided in this Manual. The activities of these establishments are subordinate to, and operated for the use of, some other establishment(s) of the same concern and are generally at locations separate from the establishment(s) served. Such establishments are called "auxiliary units." The more important types of such auxiliary units are illustrated below.

1. A separate research laboratory operated for manufacturing plants of the same concern.
2. A warehouse operated by another establishment primarily for its own use and not for public storage is auxiliary to the establishment for which it is op-

[2] Usually 100 or more employees in mining or manufacturing activity, and 50 or more employees in activities other than mining or manufacturing.

erated. Thus, warehouses may be auxiliary to manufacturing, wholesaling, or retailing operations.

3. An automotive repair shop or storage garage operated by a department store primarily for its own use and not for the public repair or storage of vehicles.
4. A separate repair shop serving various manufacturing plants of the same concern primarily for the maintenance and repair of plant machinery and equipment.

Mines and manufacturing plants operated primarily for the use of other establishments of the same firm are not considered auxiliary units, but are classified on the basis of their primary activity. Important types are:

1. A coal mine operated by a steel company for its own use is classified as a coal mine.
2. A tin can manufacturing plant operated by a canning company for its own use is classified as a tin can manufacturing plant.
3. A printing plant operated primarily for the use of another establishment(s) of the same company is classified as a printing plant.

Central and District Administrative Offices

A central or district administrative office is an establishment primarily engaged in general administrative, supervisory, purchasing, accounting and other management functions performed centrally for other establishments of the same company.

Industrial Classification of Auxiliary Units and Central and District Administrative Offices

Auxiliary units and central and district administrative offices, when separately reported, should be classified on the basis of the most appropriate Major Group representing the primary activity of the establishments served. All such units will be assigned a four digit code, the first two digits being the appropriate Major Group code (01 through 89); the third digit a zero code and the fourth digit to identify

[fol. 6620] the type of unit. The fourth digit code numbers for general use are as follows:

1—Central or district administrative offices
2—Research laboratories
3—Warehouses
9—Other auxiliary units

Thus, a central or district administrative office serving establishments primarily engaged in activities classified in Major Group 33.—Primary Metal Industries—would be 3301; a warehouse serving establishments primarily engaged in activities classified in Major Group 54.—Retail Trade—Food—would be 5403.

Agencies desiring to distinguish additional types of auxiliary units, other than those listed above, will so advise the Chairman of the Technical Committee on Standard Industrial Classification, Office of Statistical Standards, Bureau of the Budget, to assure comparability among agencies.

Basis of Establishment Classification—Code Assignment

Each establishment is assigned an industry code on the basis of its major activity, which is determined by the product or group of products produced or handled, or services rendered. Ideally, the principal product or service should be determined by reference to "value added." In practice, however, it is rarely possible to obtain this information for individual products or services, and it becomes necessary to adopt some other criteria which may be expected to give approximately the same results. It is recommended, therefore, that, as far as possible, the following characteristics be used for each of the major economic sections:

Economic Section	Characteristics
Agriculture, forestry, and fisheries (except agricultural services)	Value of production.
Mining	Value of production.
Construction	Value of work done.
Manufacturing	Value of production.
Wholesale and retail trade	Value of sales.

Economic Section	Characteristics
Finance, insurance, and real estate	Value of receipts.
Services (including agricultural services)	Value of receipts.
Government	Function.

Occasionally in cases of mixed businesses, the above characteristics cannot be determined or estimated for each product or service, and less frequently a classification based upon the recommended characteristics will not represent adequately the process or activity of the establishment. In such cases, if employment information is available, the major activity should be determined by the activity in which the greatest number of employees worked.

[fol. 6621] Structure of Classification

The structure of the Classification makes it possible to classify establishments by industry on either a two digit, a three digit, or a four digit basis, according to the degree of detail in information which may be needed. It permits an agency to select the level of detail considered most appropriate for presentation of its data. Also, it permits an agency to use additional subdivisions in adopting this Classification for its own use, while still retaining comparability with the classifications used by other agencies. Furthermore, comparability with the Classification may be maintained on a two digit basis by combining groups or industries within a Major Group; similarly, comparability may be maintained on a three digit basis by combining industries within a three digit group. All groupings or industry subdivisions should be clearly labeled.

Some agencies may wish to use the numbering system of the Classification; but other agencies will, no doubt, find it more convenient to adapt their present numbering system to this Classification.

Agencies which use the three digit code may use a zero temporarily on the third digit position for coding reports on which available information is inadequate for proper allocation to a specific three digit group. For example,

Major Group 25.—Furniture and Fixtures—is divided into the following groups:

251 Household Furniture
252 Office Furniture
253 Public Building and Related Furniture
254 Partitions, Shelving, Lockers, and Office and Store Fixtures
259 Miscellaneous Furniture and Fixtures

If an establishment is described as engaged in manufacturing furniture, the report should be coded as "250" until sufficient information is obtained to assign the establishment to the appropriate group.

An agency which uses the four digit code may use a zero temporarily, in the fourth position, to code reports for which the information available is inadequate for proper allocation to a specific industry.

It will be noted that whenever number nine has been used on the third or fourth digit position, it has been assigned to miscellaneous three digit groups or four digit industries covering establishments not elsewhere classified. The establishments grouped at the four digit level as "not elsewhere classified" may not constitute homogeneous groups but are treated as separate industries for purposes of this Classification.

Acknowledgments

In the preparation of this revised edition of the Standard Industrial Classification Manual, the Technical Committee wishes to acknowledge the valuable assistance received from the Advisory Council on Federal Reports, of which Mr. Merrill A. Watson, National Shoe Manufacturers Association, is Chairman. The review of the Manual by [fol. 6622] the Advisory Council was carried out under the general guidance of a Coordinating Committee consisting of:

P. K. Lawrence, E. I. duPont deNemours and Company, Chairman
Preston B. Bergin, National Association of Blueprint and Diazotype Coaters

A. J. Nesti, National Electrical Manufacturers Association

John H. Seaton, Pennsylvania Manufacturers Association

Earl L. Knight, Pennsylvania Manufacturers Association (alternate for Mr. Seaton)

Horace Stringfield, Iron and Steel Institute

J. V. Henlock, United States Steel Corporation (alternate for Mr. Stringfield)

Consultants

R. Buford Brandis, American Cotton Manufacturers Association

C. F. Graf, Jr., International Business Machines Corporation

Mr. Russell Schneider, Executive Secretary of the Advisory Council, was particularly helpful in the establishment of committees of industry representatives to review specific sections of the Manual. Twenty-six committees were established, each of which made many valuable suggestions on the Classification. The Technical Committee also wishes to express appreciation for many constructive criticisms and suggestions received from the American Marketing Association, Dun and Bradstreet, McGraw-Hill Publishing Company, the National Bureau of Economic Research, various trade unions, trade associations, and Federal and States agencies.

[fol. 6623]

Group No.	Industry No.	
334		Secondary Smelting and Refining of Nonferrous Metals and Alloys
	3341	Secondary smelting, refining, and alloying of nonferrous metals and alloys Establishments primarily engaged in recovering nonferrous metals and alloys from new and used scrap and dross, but which are not engaged in further fabrication. This industry includes establishments engaged in both the recovery and alloying of precious metals. Plants engaged in the recovery of tin through

Group No.	Industry No.	
		secondary smelting and refining, as well as by chemical processes are included in this industry. Establishments primarily engaged in assembling, sorting, and breaking up scrap metal, without smelting and refining are classified in trade industries.
335		Rolling, Drawing and Extruding of Nonferrous Metals
	3351	Rolling, drawing, and extruding of copper Establishments primarily engaged in rolling, drawing, and extruding copper, brass, bronze, and other copper base alloy basic shapes, such as plate, sheet, strip, bar, and tubing. Establishments primarily engaged in recovering copper and its alloys from scrap or dross are classified in Industry 3341.
	3352	Rolling, drawing, and extruding of aluminum Establishments primarily engaged in rolling, drawing, and extruding aluminum and aluminum base alloy basic shapes, such as plate, sheet, strip, bar, tubing, and foil.
	3356	Rolling, drawing, and extruding of nonferrous metals, except copper and aluminum Establishments primarily engaged in rolling, drawing, and extruding nonferrous metals other than copper (Industry 3351), and aluminum (Industry 3352). The products of this industry are produced in the form of basic shapes, such as plate, sheet, strip, bar, and tubing. Establishments primarily engaged in recovering nonferrous metals and alloys from scrap or dross are classified in Industry 3341; in manufacturing gold, silver, tin, and other foils except aluminum in Industry 3497; and aluminum foil in Industry 3352.
	3357	Drawing and insulating of nonferrous wire Establishments primarily engaged in drawing, drawing and insulating, and insulating wire and cable of nonferrous metals from purchased wire bars, rods, or wire.

Group No.	Industry No.	
336		Nonferrous Foundries

This group includes establishments primarily engaged in manufacturing castings and die castings of aluminum, brass, bronze and other nonferrous metals and alloys. These establishments generally operate on a job or order basis manufacturing castings for sale to others or for interplant transfer. Establishments which produce nonferrous castings and which are also engaged in fabricating operations such as machining, assembling, etc., in manufacturing a specified product are classified in the industry of the specified product. Nonferrous castings are made to a considerable extent by establishments classified in other industries that operate foundry departments for the production of castings for incorporation, in the same establishment, into such products as machinery, motor vehicles, etc. Establishments primarily engaged in manufacturing iron and steel castings are classified in Group 332.

[fol. 6624] *Appendix

Criteria for Recognizing Manufacturing Industries in the Standard Industrial Classification

General Comments:

The Standard Industrial Classification defines industries in accordance with the existing structure of the American economy. An industry is a grouping of establishments primarily engaged in the same or similar lines of economic activity. In the manufacturing division, the line of activity is generally defined in terms of the product made, materials consumed, or process of manufacture used.

Sometimes a common process of manufacture may result in an industry of considerable size and a wide variety of products; e.g., meat packing, and blast furnaces, steel works and rolling mills. In other instances, the production of an industry may be limited to a single product, such as chewing gum or wallpaper. To be recognized as an industry each group of establishments must have significance from the standpoint of number of production workers, value added by manufacture, value of shipments, and number of establishments. Size of an industry is not the sole criterion for its recognition; it is also important that an industry comprise a group of establishments of which the output of products or processes defining the industry (primary products of the industry) account for a relatively high proportion of (a) the total shipments or receipts of the industry (specialization ratio), and (b) the total output by all industries of the products or processes which are primary to the industry (coverage ratio).

The quantitiative standards for size, specialization and coverage for manufacturing industries that have been established are described in subsequent paragraphs. There may be a few instances where other important considerations will warrant the establishment or retention of an industry which does not satisfy size, specialization and coverage criteria.

As a result of the application of these criteria, there will be "leftover" segments of American industry. Lines of business activity which do not satisfy the criteria for

the recognition of an industry, if they are very closely associated with the activities of another industry, may be included with that industry. This may have the effect of reducing the specialization ratio of the industry with which this line of activity is combined, but such a procedure may be preferable to including the line of activity in a "miscellaneous" or "not elsewhere classified" category for that particular three digit group. Each case must be evaluated on its own merits. It may be better to allow a small element of impurity to be introduced into a [fol. 6625] given four digit industry by associating it with line of activity which is quite closely related rather than to increase the size of the "miscellaneous" category for the three digit group by adding another line of activity, since the "miscellaneous" categories are heterogeneous and are primary to the industry (coverage ratio).

Standards for Criteria:

As a result of the Census of Manufactures, data (number of establishments, employment, value added, etc.) are available for manufacturing as a whole. Knowing the number of industries, values for each desired item have been calculated for an "average" industry. These values for the "average" industry were used as the basis for measuring size. For each desired item, a number of points were awarded an industry, depending on the industry's relationship to the size of the "average" industry. The points awarded were equal to the percent of the "average" industry. The points for the various items were averaged with a system of weights to secure the final score for an industry. The score determines whether the industry is to be considered sizable or not.

Size Criteria:

Size was measured by a comparison of four items as follows:

1. Number of employees
2. Value added by manufacture
3. Value of shipments
4. Number of establishments

Number of employees and value added are recognized as being more significant and reliable measures of industry size than are value of shipments and number of establishments. Value of shipments includes the value created in other industreis or other economic divisions such as Agriculture, etc., and does not measure value of income produced in the specific manufacturing industry. In some instances, the large duplication of value of shipments within an industry makes publication of the figure meaningless. A count of establishments in each industry is of limited significance as it treats both large and small establishments as of equal importance. In addition, the derivation of an "average" number of establishments per industry reflects, to a large extent, the very numerous plants in a relatively few industries. For example, five industries (Bakeries, Sawmills, Newspapers, Commercial Printing, and Concrete Products) account for approximately 22 percent of the number of establishments, but only 8 percent of the number of employees and value added by manufacture.

Generally speaking, an existing Standard Industrial Classification industry is considered as sizable if it attains a point score of 10 or higher. The point score for a new industry is 20 or higher. In deriving the final score based on the four items included in the determination, double weight is given to the "number of employees" and to "value added." The final score is a measure in percent of the size of an industry in relation to an "average" industry.

[fol. 6626] Industries should not be eliminated because they fail to attain the recommended size scores, without giving due attention to the comments contained in the section dealing with the application of criteria.

Specialization Ratio and Coverage Criteria:

The minimum ratio for industry specialization is 80. When applying the specialization test, it is well to remember that an industry may sometimes specialize in only one product (malt or beet sugar). In other instances, establishments in an industry may typically produce and thus specialize in a wide variety of products (Meat Packing

Plants; Blast Furnaces, Steel Works, and Rolling Mills; and Radio and Television Transmitting, Signalling, and Detection Equipment and Apparatus). For varying reasons, industries have through the years developed in a diverse manner. It is important, therefore, that the specialization ratios not be applied rigidly, but that they be interpreted in the light of the nature of the particular industry.

In applying coverage ratio factors, separate criteria are established for industries with "captive" output within and outside the industry as distinguished from industries primarily producing for commercial sale. The minimum coverage ratio for industries described in the Standard Industrial Classification as producing for commercial sale is 70; the coverage ratio for all other industries is 50, except for industries producing from purchased materials (stage of process classification). The minimum coverage ratio for this latter group of industries (Blended and Prepared Flour, etc.) is 33. The coverage ratio for industries with significant "captive" counterparts (minimum coverage of 50 percent) should be computed on the basis of the proportion of total output accounted for by the given industry (shipments for sale, interplant transfer, and production for use within the same establishment) compared with total output in all industries (shipments for sale, interplant transfer, as well as production for use within the same establishment). Examples of such industries are Gray Iron Foundries, Metal Stampings, and Iron and Steel Forgings.

Application of Criteria:

The application of the size, specialization and coverage criteria to a particular industry is subject to other considerations. Industries which appear to qualify because of special or unique factors not included in the formula described above may be retained. Examples of such factors are defense mobilization; very large industries with specialization slightly below 80 percent; and industries of special significance in economic fluctuations which are also near the lower specialization limit, such as Machine Tools.

Separate industries for plants in an area that is

rapidly expanding but which does not meet the quantitative measures in the usual reference statistics also may be retained. Such retention is based on substantial statistical evidence of current size, or conclusive evidence of growth by a specified time, and on the industries meeting the customary requirements, other than size, for establishing an industry.

[fol. 6627] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 75

Mineral Industry Surveys

United States Department of the Interior, Bureau of Mines

Stewart L. Udall, Secretary
Marling J. Ankeny, Director

Mineral Market Report
Mineral Market Survey No. 3349

Aluminum and Bauxite in 1961
(Preliminary Annual Data)

Aluminum: Domestic primary aluminum production in 1961 was approximately 1,880,000 short tons, a drop of 6 percent from the record year of 1960, according to the Bureau of Mines, U.S. Department of the Interior. Shipments of primary metal ingot increased slightly during 1961 in comparison to 1960, and exceeded the quantity produced with a resulting decline in stocks at reduction plants.

Rated annual aluminum production capacity of United States plants increased 15,000 tons during the year to 2,483,750 tons when Harvey Aluminum, Inc. announced the completion of 60 new electrolytic cells at its reduction plant at Dallas, Oregon. A further increase in domestic aluminum production capacity was forecast. Cerro Corporation was considering building a production plant along the Columbia River at Wauna, Oregon. Cerro, as a result of its acquisition of the United Pacific Aluminum Corp., had a contract with Bonneville Power Administration to receive 90,000 kw of electrical power for the plant, with the delivery to start September 1, 1963. This amount of power

would permit operation of a plant rated at about 55,000 ton capacity. Consolidated Aluminum Corp. announced that a $27 million basic aluminum plant would be built near New Johnsonville, Tennessee. Howe Sound Co. was considering three sites for a new $45 million aluminum plant. Harvey also announced possible construction of a new 75,000 ton plant in the Pacific Northwest.

Several firms announced a potential increase in aluminum production capacity through utilization of new refractory materials in the cathode electrode assembly. Several standard sized cells have been converted to determine the conditions likely to be encountered in the plant when the new materials are utilized extensively.

Domestic capacity to produce super pure aluminum was increased to nearly 4,800 tons per year when Kaiser Aluminum & Chemical Corp. activated five new cells to produce the 99.99 plus percent metal. Each cell has an annual capacity of 380,000 pounds which increased Kaiser's total capacity to more than 2,650 tons per year. As a result of a new process developed during the year, Aluminum Company of America announced it too would market super pure alumnium. No capacity figure was released.

During September the price of primary aluminum ingot dropped 2 cents to 24 cents a pound. A decrease in the price of aluminum to U.S. customers was first announced by Aluminum Limited. The U.S. producers then announced the reduction to meet the new price. Earlier in the year Kaiser had reduced the price of super pure aluminum from 47½ cents per pound to 45½ cents per pound.

Prepared December 19, 1961, by K. B. Higbie, C. I. Wampler, and Mary E. Trought, under the supervision of P. F. Yopes, Chief, Branch of Nonferrous Metals, Division of Minerals.

[fol. 6628] The major outlet for aluminum in the United States continued to be the building and construction industry according to preliminary data released by the Aluminum Association. Transportation, electrical and container applications were the next most significant consuming areas.

Exports of primary aluminum metal decreased over 50 percent during 1961. For the first none months of the year less than 100 thousand tons of crude and alloyed aluminum

was exported in comparison with over 225 thousand tons in the same period of 1960.

Bauxite: Domestic production of bauxite in 1961 was 1.22 million long tons or 61 percent of that produced during 1960. Total imports of bauxite were approximately 8.7 million tons, equal to the 1960 imports. Jamaica supplied over 50 percent of the imports, Surinam approximately 25 percent, and the Dominican Republic, Haiti, and British Guiana most of the remainder.

The U.S. Government signed barter agreements providing for the delivery of 1.2 million long dry tons of Jamaican-type bauxite, and 1.0 million long dry tons of Surinam-type bauxite.

Research activities aimed at extracting aluminum from new ore sources continued at a high pace. Technological investigations have centered around extracting alumina from raw materials other than bauxite. Olin Mathieson Corp. has piloted a process for producing high-quality aluminum sulfate from domestic clay. North American Coal Co. continued to study the recovery of alumina from coal-mine shale.

Secondary Aluminum: Preliminary data for 1961 showed that in comparison with 1960 the consumption of aluminum-base scrap by industrial users and production of finished aluminum alloys by the independent producers declined. This was the second consecutive year in which the volume dropped. Based on 9 months' figures scrap consumption for 1961 totaled 385,000 short tons, down 56,000 tons or 13 percent from the previous year. The estimated metallic recovery was 323,000 tons and the estimated aluminum content was 300,000 tons. New scrap accounted for 73 percent of the total scrap consumed. The remaining 27 percent was obsolete scrap and sweated pig. Ingot production in 1961 is estimated at 269,000 tons compared with 282,000 tons in 1960. Estimated shipments of finished alloys by the independent producers totaled 271,000 tons, about 9,000 tons less than in 1960. Imports of scrap, an estimated 5,400 tons in 1961 was an increase of about 400 tons compared with the previous year and scrap exports showed an increase of 3,500 tons to approximatley 83,000 tons.

World Review: Bauxite world production, estimated at

24,935 long tons, was 8 percent less than in 1960. Total production of the three principal producers; the United States, Jamaica, and British Guiana showed a decrease of 26 percent. France showed an increase of 15 percent.

Aluminum production in the free world is estimated at 4 million short tons which was approximately equal to the 1960 production. France and Japan were the only countries showing production increases in excess of 10 percent. Several new reduction facilities in the United States, Norway, France, Taiwan, and India were completed during 1961, raising the world aluminum production capacity to over 6 million tons.

Several United States firms, in conjunction with various foreign corporations, announced further plans for expansion of aluminum interests throughout the world. Alcoa began development of an integrated aluminum production complex in Australis, and also made plans for the construction of a 20,000 ton per year smelter in Mexico. Kaiser planned a complete aluminum production complex in Australia and New Zealand, and also formulated plans to build reduction and rolling and fabrication facility in Japan.
[fol. 6629] Formal approval by the U.S. Government for financial assistance to the Republic of Ghana for construction of a hydroelectric dam and aluminum refinery was given. The $196 million dam will be financed with $98 million from Ghana, $27 million from the U.S. Development Loan Fund, $10 million from the Export-Import Bank, $47 million from the World Bank, and $14 million from Great Britain. The dam will provide power for an aluminum refinery to be built by a consortium composed of Kaiser and Reynolds.

Several announcements were made concerning possible new aluminum plants in other areas. Kaiser Aluminum & Chemical Corp. was awarded permission to proceed with plans for a plant with minimum capacity of 22,000 tons in Argentina. Kaiser also negotiated with the Dutch Government for construction of a new primary aluminum plant in the Netherlands. Reynolds considered building aluminum plants in the Philippines, Turkey, and Kuwait. Harvey participated with the Nova Scotian Government in a survey and study to determine the feasibility of an integrated aluminum facility there.

[fol. 6630] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 76

Economic Study

Use of Aluminum and Copper Conductors on Consolidated Edison System

[fol. 6631] February 9, 1959.

Re: Use of Aluminum and Copper Conductors on Consolidated Edison System

Mr. F. Van Olinda
Outside Plant Engineer

The attached economic study, dated February 5, 1959, on the above subject covers three major applications of aluminum on our distribution system, namely:

1. Aluminum for network bus.
2. Aluminum for underground secondary mains.
3. Aluminum for overhead conductors.

Economic comparisons are given in the study to cover costs involved in the use of aluminum or copper for each application. The report also incorporates technical reasons for the various operations involved, and a number of pertinent drawings and procedures are included. All cost data are based on figures applicable to the Brooklyn, Queens and Bronx areas.

Conclusions and recommendations based on the findings in this report are as follows:

1. Aluminum has been used on buses in network vaults since 1953 and our field experience to date and as determined by three separate inspections of these installations has been completely satisfactory. The use of the aluminum integral web bus with premanufactured snap on insulation is very popular with the field forces because of the lightness of the bus and simplified insulation. The cost of this type of bus is 53 per cent of the cost of insulated copper bus. The continuation of the practice of using this aluminum bus is justified and there appears to be no foreseeable reason for a change in this practice.

2. A trial installation of 2,200,000 feet of aluminum mains on the underground network system has been completed and we have developed methods and equipment which were put into effect and which would enable us to use aluminum if the time arrives

again when copper is unavailable or when this change could be justified. However, the cost of [fol. 6632] aluminum mains in comparison with copper mains is very much higher. Our estimates indicate that the installed costs for aluminum mains are 50 per cent higher than for copper mains. The main reasons for these higher costs are: (a) more labor and materials needed in splicing; (b) need for larger service boxes; (c) increase in costs due to the need of connections between copper and aluminum which are continually encountered on our system; (d) additional tools, etc.

There appears to be no justification for the use of aluminum on underground mains on the basis of current and foreseeable cable and installation costs. In cases of emergency, when copper is unavailable enough development work has been done so that we could then go to the use of aluminum.

3. Work on our overhead distribution system consists mainly of relatively short extensions to the existing copper overhead primary and secondary mains and, of course, the addition of services. Under these conditions, there appears to be little, if any, difference between the costs of aluminum extensions and copper extensions at the current cabie prices and with available splicing techniques.

Our experience reveals that where aluminum has been used, as described above, we have more trouble calls. The reason for the inferior operating record for aluminum is galvanic corrosion between copper and aluminum where these two metals come together and also due to the fact that aluminum to aluminum connections and aluminum to copper connections are not as satisfactory as copper to copper connections. Where aluminum is involved greater care is required in making these connections and the application of inhibitors is required. The use of aluminum in conjunction with the existing copper introduces the need for additional tools, and the field forces strongly object to the use of aluminum because of this and other practical difficulties.

[fol. 6633] On the basis of current cable prices and the type of connections available in splicing aluminum there appears to be no economic or operating advantage in its use on our system. This situation, however, should be reviewed annually on the basis of cable costs and any improvements which may occur in the connection devices. We should also continue to follow developments on aluminum connectors since their performance is pertinent to this problem.

——, ——, Division Engineer, Equipment Division.

attach.
cox.m

[fol. 6634] **Introduction**

This is a report of studies made to determine the economics of the use of aluminum in place of copper as an electrical conductor on our System. It is presented in three parts, viz. overhead, underground and network buses.

The material used in each of these three fields of application, the construction methods required, and personnel involved make for a natural division into the three groups. Thus if it is decided to use aluminum in one port and copper in another, no conflict of material, accessories, or personnel will result.

In adition to the studies noted above a section is included of source information of cable prices, and some EC specifications for overhead construction.

[fol. 6635] Part I.

Aluminum for Network Bus

[fol. 6636] Comparative Costs of Aluminum vs Copper For Network Bus Construction

Aluminum has a fundamental advantage over copper in bus construction for two reasons; it weighs about half as much as an equivalent copper conductor of same conductivity, and manufacturing costs are substantially less because aluminum shape is extruded whereas the copper is not but must be shaped by much more costly methods. In the case of our standard aluminum bus (6″ x 5″ x 3/8″ integral web channel) the weight is just 42% the weight of equivalent copper (6″ x 6″ x 1/4″ square tube).

At recent metal prices (aluminum at 25.2¢ and copper at 26.5¢/lb.) the purchase prices of aluminum and copper bus were quoted as follows:

	Costs Per Circuit Foot	
	Bare Conductor	Insulated Conductor
Copper	$39.60	$55.12*
Aluminum	14.43	25.97
Difference in favor of aluminum	$25.17	$29.15

The 33% additional cost to insulate copper results from the larger surface to be covered and the need for clips to hold in place which are not needed in the case of the aluminum channel, the shape of which is more suitable for "snap-on" insulation.

Since shop fabrication and installation costs are about the same for aluminum and copper, a reversal in this economic comparison is not likely.

Because of its lighter weight, the field forces prefer to use the aluminum bus.

Experience with the use of aluminum bus over a period of six years has been satisfactory in that the field inspections have revealed no faulty connections.

In the case of a 6 bank (460 V) job the saving in using aluminum as compared with copper is

120′ at $29.15 = $3,500 approx.

This is a saving of 53% over the purchase price of copper tube with insulation.

On the basis of present usage, there is an annual saving of approx. $39,000 realized by the use of aluminum bus.

Prepared by: L. F. Porter
1-6-59

[fol. 6637] Part II.

Aluminum for Underground Secondary Mains

[fol. 6638] Aluminum Underground Secondary Mains

Some 2,200,000 feet of aluminum 350 MCM mains cable have been installed on the underground network. This consists of a trial installation of 67,000 feet in 1952-53 and approximately 2,140,000 feet purchased in 1955 when a considerable price differential occurred favoring aluminum over copper. While operating experience with aluminum cable has been good, in that we have no record of failures, the installation cost is substantially higher than for copper and greater care is necessary to make good electrical connections. Since larger service boxes are required for splicing, the box enlargements necessary to accommodate aluminum make its general use for reinforcing existing systems excessively high in cost.

The aluminum mains were installed only in Brooklyn and Queens because much of the conduits in Manhattan and Bronx are less than 4", the minimum size required for aluminum. Also, this cable was pulled only at those locations where its use would not entail service box enlargements. Most of the cable was spliced using copper joints and copper-to-aluminum adapters since aluminum accessories were not available. However, aluminum designs have been developed for both crab and joints and individual cable limiters, and trial installations have been made of both. While aluminum limitered crab joints have not been developed because of the time and expense involved for dies, molds, etc., they could be developed if required. No satisfactory design has yet been worked out for adapters to connect aluminum services (smaller than 350 MCM) in an alumi-

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*Insulation cost estimated

num mains connector. These would be required if small aluminum services were to be used. The installation of the aluminum cable has been handicapped for a lack of a tool suitable for both copper and aluminum joints. A manufacturer is now developing such a tool, similar to the one used on copper, which is expected to be satisfactory for use on existing copper crab joints in addition to making aluminum joints.

Aluminum has certain characteristics which make it less attractive than copper, particularly for underground use: (1) the oxide layer on aluminum makes it more difficult to make an electrical connection because of the need for cleaning strands, using an oxide inhibitor in each joint and the requirement for a larger compression joint; (2) it is very susceptible to a-c corrosion; a defect in the insulation admitting a slight amount of water may lead to cable failure; (3) the cable, which has approximately 25 per cent larger outside diameter than equivalent copper, requires a minimum size 4-inch duct and the substantially larger joints require larger service boxes than would be required for the same number of copper circuits. This means that bringing a set of aluminum mains into an existing service box or replacing a set of copper mains with aluminum will frequently require a box enlargement which would not be necessary if copper were used for the new circuit.

Labor to splice aluminum is high because: (1) since we have an existing copper system, many of the aluminum connections will be made to existing copper joints, by means of adapters, at a labor cost at least twice as high as would be required for an all-copper joint; (2) in the case of all-aluminum construction approximately 20 per cent more splicing labor is required than for copper, and splicing material costs an estimated 50 to 75 per cent higher; (3) in the case of neutral cable, the aluminum must be insulated from water and where it is connected to bare copper neutrals the additional expense of water seals is incurred. For these reasons, the use of aluminum as a neutral conductor is even less attractive than its use as a phase conductor.

In the case of the aluminum cable purchased in '55, it is estimated that the installed cost was 7 per cent higher than copper costs would have been, although the purchase price for the aluminum was $2.36, as compared with $3.31 per

circuit foot for copper. Had aluminum joints been available for the installation work, it is estimated that the aluminum and copper costs, installed, would have been about the same. These comparisons are on the basis of cable installation costs, only, as box enlargements were avoided by selecting locations where enlargements would not be required.

[fol 6639] On the basis of present costs, the use of aluminum is definitely uneconomical and it appears very improbable that aluminum cable costs can become low enough in comparison to copper to compensate for the discrepancy in installation costs as illustrated in attached Table I.

attach.
Prepared by L. F. Porter
1-8-59

[fol. 6640] Aluminum Underground Secondary Mains

Table I

Summary of Costs
(Dollars Per Circuit Foot)

	Copper (1) Circuit	Aluminum Circuit (1) Installed on Existing Copper System	Aluminum Circuit (1) Installed in New Subway
Installation	$1.04	$1.47	$1.26
Less Salvage (Present Worth)	−.29	−.16	−.16
Add'l Service Box Enlargements	....	.90	.16
(for aluminum) (2)			
Net Installation	.75	2.21	1.26
Present Cable Costs ('58)	2.28	2.33	2.33
Total	$3.03	$4.54	$3.59

(1) Copper Circuit: Phase cables = 6 − #4/0 R/N + 2 − #4/0 bare copper
Aluminum " Phase cables = 6 − 350 MCM R/N (aluminum) + 2 − #4/0 bare copper

(2) Where new subway is built for aluminum cable, some service boxes must be built larger than is required for copper cable. If aluminum cable is used for all mains work (reinforcements, extensions and replacements), then some existing service boxes must be enlarged and new service boxes must be larger because of the larger aluminum splices as compared with copper.

[fol. 6641] Aluminum Underground Secondary Mains

Appendix A

1. Cable Prices Per Circuit Foot

	1955	1958
6−#4/0 R/M+2−#4/0 bare (all copper)	3.31	2.28
6−350 MCM R/N (aluminum)+2−#4/0 bare copper	2.60	2.33
*6−350 MCM R/N (aluminum)+2−350 MCM Polyethelene covered (all aluminum)	2.36	2.37

2. Basis of Comparison—Installed Costs
   (a) Comparison on circuit foot basis
   (b) Circuit length (average) = 150 ft.

3. Salvage of Cable Removed in Future

Salvage price of copper = 80% copper price. Salvage price of aluminum = 22% aluminum price. Assuming cable has an average life of 25 years, present worth of salvage = 23% of future salvage value (interest at 6%). For purpose of this study, future copper price is assumed to be 30¢ per lb. aluminum 25¢ per lb.

4. Installation Cost Data—Direct Cost Only—No Overhead
   (a) Copper Cable Installation Costs
   6−#4/0 R/N and 2−#4/0 Bare−$1.04 per circuit foot
   (b) Aluminum Cable Installation Costs

Circuit	Installed on Existing Copper System	Installed in New Subway
6−350 MCM R/N (aluminum) +2−#4/0 bare (copper)	$1.47	$1.26
*6−350 MCM R/N=2+350 MCM Polyethelene covered (all aluminum)	1.72	1.40

* Installed in 1955–58. Not recommended for future consideration.

[fol. 6642] Aluminum Underground Secondary Mains

Appendix B

Additional Subway Costs

Incurred by use of Aluminum Mains

I. Reinforce Mains on Existing System—Survey of Typical Areas

A. Brooklyn—

1. Total trench feet of subway 50,500
2. Total No. of service boxes and manholes 413
3. Average section length—(Approx.) .... 120′
4. To add (1) additional circuit copper main—thru-out enlarge 43 service boxes to 'S' boxes
5. To add (1) additional circuit of aluminum mains thru-out enlarge 26 service boxes to 'S' boxes
" 15 service boxes to 'TS' boxes

B. Queens—

1. Total trench feet of subway 45,600
2. Total No. service boxes and manholes 285
3. Average section length—(Approx.) .... 160′
4. To add (1) additional circuit of copper mains—thru-out enlarge 69 service boxes to 'S' boxes
" 2 service boxes to 'TS' boxes
5. To add (1) additional circuit of aluminum mains—thru-out enlarge 88 service boxes to 'S' boxes
" 37 service boxes to 'TS' boxes
" 3 service boxes to manholes

C. Brooklyn and Queens Areas Combined (Difference between Aluminum and Copper)

1. In recent years secondary mains work has been divided as follows— Brooklyn 40% (Approx.)
Queens 60% "
2. Additional service box enlargements required for aluminum per 1000 circuit feet of mains cable installed:

	Number
Increase to 'S' box	.38
" to 'TS' "	.38
" to manholes	.04

3. Cost of service box enlargements

to 'S' boxes	.38 x $ 614 =	$234	per 1000 circuit ft.
to 'TS' "	.58 x 772 =	448	" " " "
to manholes	.04x 2,374 =	95	" " " "
	Total	$777	

[fol. 6643]

4. Cost to divert ducts and piece-out mains cables

Since some service boxes must be relocated to permit enlargement, duct diversions and mains piece-outs are required.

a. Number of diversions required per 1000 circuit feet of new mains installed = .50

b. Cost of duct diversions
.50 x $350 = $175 per 1000 circuit feet

c. Cost of mains piece-outs
.50 x $264 = $132 per 1000 circuit feet

5. Total Cost to Enlarge Service Boxes

a. build service boxes	$ 777	per 1000 circuit ft.
b. divert ducts	175	" " " "
c. piece-out mains	132	" " " "
Total	$1,084	

II. Extend Mains—New Subway

Based on survey of jobs issued, additional cost of boxes to accommodate aluminum cable (additional to requirements for copper cable)
$160 per 1000 circuit feet

III. Weighted average of enlarging existing service boxes and building larger new service boxes for aluminum.

It is estimated that 80% of all mains cable splices are made in existing or enlarged service boxes. On this basis, the weighted average incremental cost of service boxes for aluminum is $900 per 1000 circuit feet higher than would be required for copper cable.

[fol. 6644] Part III

Aluminum for Overhead Conductors

[fol. 6645] Resume and Conclusions

Overhead System Cost Study

Study of the Overhead use of copper and aluminum was made in three pieces, viz.

A) Primary Feeder Installations (Table I)
B) Secondary Mains Installations (Table II)
C) Service Drops (Table III)

An examination of the data in these tables indicates that on our System there is little or no saving in the use of aluminum cable over copper. This is due to the higher installation cost for aluminum.

Table IV compares costs for a package installation for various combinations. Again it is seen that the savings realized are small and when scrap values are included the saving is in favor of copper for covered primary.

Appendix I indicates the derivation of a formula for use in determining when to purchase aluminum or copper cable.

Appendix II covers the evaluation of the factor "k" for use in the equation of Appendix I.

This situation should be reviewed on a yearly basis or whenever there is a large difference in the prices of the raw copper and aluminum.

Plate I shows the variation in the price differences between copper and aluminum cables of comparable current carrying capacities. It also shows the variation in price difference between the raw metals.

Data on cable prices and specs relating to Overhead Construction are included under "Source Data".

[fol. 6646] Pertinent Facts Needed to Evaluate the Use of Aluminum

Aside from the matter of material and construction costs, aluminum as a metal has characteristics which make it a difficult one to work with from an electrical point of view. Surface oxides, having a high electrical resistance, form almost instantly after the surfaces have been cleaned. To

obtain oxide free surfaces to provide a low resistance joint, they must be cleaned of oxide through a grease coating that prevents the entrance of air to the surfaces being cleaned. Practically, this means that additional care must be used in preparing oxide-free surfaces at points where joints are to be made. This requires special training of men and closer supervision.

In addition, aluminum is relatively soft and cold flows under sustained pressure. This action reduces contact pressure in the joint, increases joint resistance, and results in joint failure if the connector is not properly designed.

Electrolytic potencial between copper and aluminum is in the order of 2 volts. In the presence of an electrolyte, corrosion takes place. This very frequently results in the formation of high resistance compounds in the joint that leads to ultimate failure. In other cases the aluminum conductor is corroded through at a point near the connector.

To prevent entrance of moisture into the joint a very thorough insulating job must be done. A covering that permits entrance of moisture and traps at the joint will result in more corrosion than if no covering had been provided.

Thus wherever aluminum conductors are joined to copper the possibility of electrolytic corrosion exists and special attention is required to limit its occurrence.

For this reason it is recommended that on new construction we do not intermix copper and aluminum conductors; that we install either all aluminum (primary, secondary, and service drops) or all copper as prices dictate.

To this end the formula developed for use in purchasing is based on a "package" deal consisting of average extensions of 600 feet of 4 wire primary, 600 feet of 4 wire secondary and 16, 3 wire service drops of 50 feet each.

Galvanic corrosion at connections where copper and aluminum come together brings about an incremental rate of failure as compared to an all copper system. The "cold flow" property of aluminum under connector pressure is another source of difficulty which has been non existent in the case of all copper connections.

With added experience and continuing development of connectors by manufacturers the time will come when these connectors will have the same reliability as those used on copper.

[fol. 6648]

Table II

Cost Comparison

Secondary Mains Installation, Overhead—2/0 Copper vs. 4/0 Aluminum

	Install Two Sets of Four Sec Dead Ends		Install Four Wires Sight and Sag		Cost of Conductor	
Material	Labor	Material	Labor	Sub Total	Material **	Total
			For 300 Foot Extension			
Copper......	43.20	9.68	76.47	129.35	257.53	386.88
Aluminum....	43.20	9.68	109.14	162.02	196.58	358.60
			For 600 Foot Extension			
Copper......	43.20	9.68	152.94	205.82	515.07	720.89
Aluminum....	43.20	9.68	218.28	271.16	393.15	664.31

** Cost includes 21% for storeroom charges and corporate overhead.

11-28-59.

[fol. 6649]

Table III

Cost Comparison

Overhead Service Drops—Aluminum vs Copper

One 3 Wire Service — Average Run of 50 Feet

Size of Sec. Mains	Size of Service Drop	Service Drop Stringing	Cost of Pole Splice Material	Cost of Pole Splice Labor	Cost of House Splice Material	Cost of House Splice Labor	Cost of Dead Ends Pole	Cost of Dead Ends House	Sub Total	Cost of Conductor **	Grand Total
2/0 Copper	#6 Copper	2.97	2.53	2.97	0.99	2.97	6.79	6.96	26.18	8.98	35.16
2/0 Copper	#4 Aluminum	2.97	2.57	2.97	1.70	2.97	6.79	6.96	26.93	5.95	32.88
2/0 Copper	#2 Copper	2.97	2.53	2.97	1.34	2.97	6.79	6.96	26.53	19.84	46.37
2/0 Copper	1/0 Aluminum	2.97	2.57	2.97	1.70	2.97	6.79	6.96	26.93	11.76	38.69

** Cost includes 21% for storeroom charges and corporate overhead.

1-28-59

[fol. 6647]

Table I

Cost Comparison

Primary Installation, Overhead—2/0 Copper vs 4/0 Aluminum

Material	Remove Set of Four Dead Ends	Install Set of Four Tension Splices		Install Set of Four Primary Dead Ends		Install Four Wires Sight and Sag	Sub-Total	Cost of Cable **		Total
	Labor	Labor	Material	Labor	Material	Labor		Material		
				For 300 Foot Extension						
Copper......	24.30	2.16	6.63	54.00	38.14	76.47	201.70	Bare	224.74	426.44
								Covered	257.53	459.23
Aluminum...	—	—	—	*151.20	95.64	109.14	355.98	Bare	111.32	467.30
								Covered	196.58	552.56
				For 600 Foot Extension						
Copper......	24.30	3.02	9.28	54.00	38.14	152.94	281.68	Bare	449.49	731.17
								Covered	515.07	796.75
Aluminum...	—	6.90	1.95	*151.20	95.64	218.28	474.01	Bare	222.68	696.69
								Covered	393.15	867.16
				For 1000 Feet Extension						
Copper......	24.30	3.60	11.04	54.00	38.14	254.90	385.98	Bare	749.14	1,135.12
								Covered	858.47	1,244.45
Aluminum...	—	11.50	3.26	*151.20	95.64	363.80	625.44	Bare	371.03	996.47
								Covered	655.28	1,280.72
				For 2000 Foot Extension						
Copper......	24.30	5.04	15.45	54.00	38.14	509.80	646.73	Bare	1,498.27	2,145.00
								Covered	1,716.94	2,363.67
Aluminum...	—	23.00	6.52	*151.20	95.64	727.60	1,003.96	Bare	742.07	1,746.03
								Covered	1,310.57	2,320.53

x Apportioned cost based on 1500 ft. reels of cable.
* Two required per extension.
** Cost includes 21% for Storeroom charges and corporate overhead.
The use of dead ends is based on the fact that most aluminum extensions at present will be from existing copper conductors.

11-28-59

[fol. 6650]

Table IV

Total Cost of Primary and Secondary Extensions and Service Drops
Consisting of
600 ft. Primary, 600 ft. Secondary, and 16 Service Drops

Conductor	Item No.	Copper Bare	Copper Covered	Aluminum Bare	Aluminum Covered
Primary	1	731.17	796.75	696.69	867.16
Sec. Mains	2	*	720.89	*	664.31
(16) Services	3	*	562.56 (#6)	*	526.08 (#4)
(16) Services	4	*	741.92 (#2)	*	619.04 (1/0)

* Use Covered Wire Prices.

Summations

	Copper Bare	Copper Covered	Aluminum Bare	Aluminum Covered
Items (1+2+3)	2,014.62	2,080.20	1,887.08	2,057.55
" (1+2+4)	2,193.98	2,259.56	1,980.04	2,150.51

Summations (Scrap Value Included)

	Copper Bare	Copper Covered	Aluminum Bare	Aluminum Covered
Items (1+2+3)	1,897.62	1,963.20	1,868.85	2,044.03
" (1+2+4)	2,060.74	2,126.32	1,960.01	2,135.59

Difference in Overall Cost (Scrap Value Included)

For Bare Primary

Service Drops	Costs: Copper	Costs: Aluminum	Saving for Aluminum: Dollars	Saving for Aluminum: %
#6 Cu vs #4 Al	1,987.62	1,863.85	28.77	1.51
#2 Cu vs 1/0 Al	2,060.74	1,960.01	100.73	5.0

For Covered Primary

Service Drops	Costs: Copper	Costs: Aluminum	Saving for Aluminum: Dollars	Saving for Aluminum: %
#6 Cu vs #4 Al	1,963.20	2,044.03	−80.83	−4.1
#2 Cu vs 1/0 Al	2,126.32	2,135.59	− 9.27	−0.43

Notes:

1. Scrap value of copper taken as 60% of electrolytic.
2. Scrap value of aluminum taken as 22% of virgin metal for covered wire and 41% for bare wire.
3. Assumed cost of copper 25 yrs. hence—30¢ per lb.
4. Assumed cost of aluminum 25 yrs. hence—25.2¢ per lb.
5. Present value of scrap is 23% of its value 25 yrs. hence.

1-28-59

[fol. 6651]

Appendix I

Development of Formula for Purchasing Cable For Overhead Use

When installed cost of aluminum cable is equal to the installed cost of copper cable there is no advantage (saving) in the use of aluminum.

This is expressed by the following equation:

$$I_c + C_c - S_c = I_a + C_a - S_a \qquad \text{(Equation A)}$$

Where I = Installation Cost
C = Cable Cost (Purch. Price x 1.21)
S = Scrap Value

Subscripts: $_c$ = copper; $_a$ = aluminum

For this study (Nov. 1958) I, C, and S will be taken for a package deal, viz; 600 ft. of 3¢, 4 wire pri., plus 600 ft. of 3¢, 4 wire secondary; plus 16—3 wire services.

$$I_c = 281.68 + 205.82 + 418.88 = 906.38$$
$$I_a = 474.01 + 271.16 + 430.88 = 1176.05$$
$$C_c = 515.07 + 515.07 + 143.68 = 1173.82$$
$$C_a = 393.15 + 393.15 + 95.20 = 881.50$$

Scrap value of copper is approximately 80% of virgin while that of aluminum is 22% of virgin for covered cable and 41% for bare cable.

600 feet of 2/0, 4 wire, pri. copper cables contains	600 x 4 x 0.403	= 967#	copper
600 feet of 2/0, 4 wire, sec. " " "		= 967#	"
Sixteen 50′ runs of 3 wire cu. Service cables "	50 x 3 x 16 x 0.0795	= 191#	"
	Total	2125#	"

Present value of scrap copper to be sold 25 years hence is 23% of the assumed scrap price at that time.

If we assume a price of 30¢ per lb. for virgin copper its scrap value today is 30.0 x 0.8 x .23 = 5.5¢ per lb.

Total scrap value is 2125 x .055 = $117.00.

The aluminum conductors weigh 1068#; therefore if we assume a value of 25.2¢ for virgin aluminum the present per pound scrap value is $0.0127 for covered cable.

The total scrap value is 0.0127 x 1068 = $13.70.

Transposing the equation, we get

$$C_c = (I_a - I_c) + (C_a - S_a + S_c)$$

[fol. 6652] This equation gives the break even price that may be paid for copper cable when the price of aluminum cable is known.

Example:

For values given above

$$C_c = (1176.05 - 906.38) + 881.50 - 13.70 + 117.00$$
$$= 269.67 + 881.50 + 103.30 = 1254.47$$

This represents the maximum price that may be paid for copper cables to break even. Comparing this with prices of copper cable shown, in the report we observe

From Table I (600 ft. extension), Covered Cable..........	$ 515.07
From Table II (600 ft. extension), Covered Cable..........	515.07
From Table III (16 service drops @ 8.98 ea...............	143.68
Total price of copper cable..................................	$1173.82

Since this value is less than the $1254.47 determined by the formula, we should be using copper instead of aluminum now.

On the basis that this is done and we start using copper, should aluminum costs change in the future to indicate equal costs to copper, we should not make the change at that time. To avoid seesawing a factor (k) of 1.20 should be introduced to Equation A, this factor being designed to cover certain incremental costs associated with aluminum which could not be readily evaluated. (See Appendix II) This would change the form of Equation A to

$$I_c + C_c - S_c = k\,(I_a + C_a - S_a) \quad \text{(Equation B)}$$

By the same token if at some future time aluminum is in use on our system and we are considering reverting to copper due to economic and other reasons, then, the factor (k) to be used in Equation B should be 1.10 instead of 1.20 in order to avoid frequent reversals of procedure.

A. F. Newman.

1-28-59

[fol. 6653] **Appendix II**

Derivation of Factor "k"

In order to arrive at the "k" factor in the equation of Appendix I it is necessary to evaluate some of the incremental operations involved in the use of aluminum conductors. Some of the items are impossible to evaluate exactly but approximations will be made.

The operations referred to are:

1. To prevent electrolytic corrosion of copper—aluminum joints special care is required to properly insulate the joint to prevent entrance of moisture.
2. Wire brushing of aluminum conductors to remove oxides at the joint location and the application of grease to minimize reoxidation requires additional care and effort.
3. To obtain good low resistance joints proper bolting torques must be used. This is more important with aluminum than with copper due to the aluminum being softer than copper.

All of these items require more labor and supervision than for their equivalent copper joints. While our figures on primary and secondary mains reflect the real costs involved with the two metals the incremental costs in labor and supervision involved in services are not in the picture. It is estimated that these costs will be 10% greater for aluminum than for copper.

For our Package which includes 16 Services, 10% of the total labor and supervision costs for services is $33.

Because of the characteristics mentioned in items 1, 2 and 3, there are more complaints of flickering lights and no lights. This is not conducive to good customer relations and also it means that a crew must be sent out to correct the complaint.

Currently, the failure rate of aluminum joints is greater than copper by 4 per 1000 services per year. However, since electrolytic corrosion, reoxidation, and loss of contact pressure due to cold flow of aluminum are cumulative effects, it is expected that the failure rate will increase with time. Just how such this increase will be is not predictable.

The number of failures of copper joints is very low.

The average cost of a service call is $25. On the basis of 4 calls per 1000 services in the first year the outlay is $100 per 1000 services. With the increase of failure rate over the years, we can assume conservatively an average cost of $150 per 1000 services per year.

This represents the excess yearly maintenance cost due to the use of aluminum and is a continuing one. The present worth of this expenditure over a 25 year period is $150 \times 12.78 = \$1916/1000$ Services. For our Package the present worth is $\frac{1916}{1000} \times 16 = \$30.60$. If the number of failures per year increase beyond the value assumed, then this figure would have to be increased correspondingly.

[fol. 6654] In addition to the above, if purchase of aluminum and copper cable were being made on small changes in prices, accessories and cable will be in stock for both metals. It is estimated that it will add 7½% to the handling costs of the materials. This would amount to $.075 \times 1356 = \$101.75$ for the Package. The figure at $1,356 represents the cost of materials in the Package.

The sum of the items enumerated above amounts to $\$101.75 + \$30.60 + \$33.00$ or $165.35. This represents 8.3% of the Package cost.

It is believed that a differential of 20% in installed costs represents a better evaluation of the disadvantages associated with the use of aluminum, and to avoid frequent seesawing from one metal to the other. The constant (k) of Equation B then becomes 1.2.

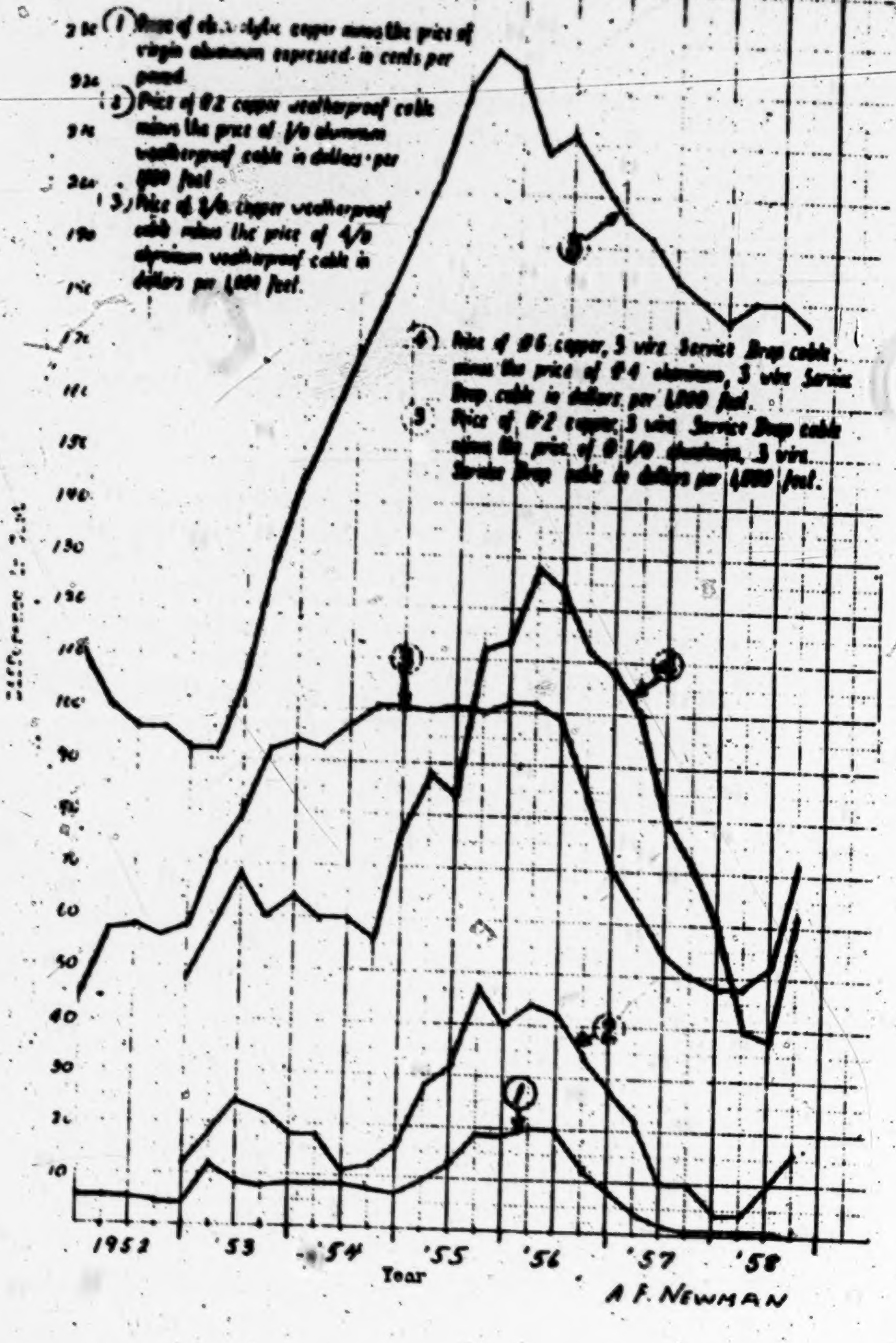
Prepared by
A. F. Newman

1-28-59

[fol. 6655]

PLATE

Differences in Raw Metal and Cable Prices



A. F. NEWMAN

[fol. 6656] **Source Data**

[fol. 6657] **Consolidated Edison Company of New York, Inc.**

Memorandum

November 20/1958.

Re: Copper vs. Aluminum Cable

Mr. F. Van Olinda
Outside Plant Engineer

Attention: Mr. C. P. Xenis

In accordance with your recent request, the prices paid for certain overhead cables made of copper and aluminum conductors have been reviewed and are shown on the attached tabulations, together with the corresponding prices of Electrolytic Copper and Ingot Aluminum.

The data has been incorpoarted into chart form for the Weatherproof Wire and Service Drop Cables as per attached Charts. There were too few transactions to warrant charting the Bare Wires.

From the data and the charts, it is apparent that, in general, the copper cables fluctuate in line with major changes in the price of Electrolytic Copper. The aluminum cables have sold with little regard to the prevailing price of Aluminum Ingot, since the aluminum fabricators have been more interested in capturing markets from copper. Hence aluminum cable prices have been dominated more by the competitive situation of the moment, rather than by basic metal prices. This tendency is expected to persist for sometime in the future.

It will be noted that during the seven year period under review, copper has risen from 24½¢ to 46¢ per lb., declined to 25¢ and is currently selling for 29¢ per lb. Aluminum on the other hand, has only risen from 19¢ to 28.1¢, declined to 26.1¢, and is currently selling for 26.8¢ per lb. There is a marked disparity in the relationship between scrap and

virgin metal prices, viz: Scrap Copper 23¢ vs. 29¢ Virgin, Scrap aluminum 6-11¢ vs. 26.8¢ Virgin. This fact should be taken into consideration in any long range study.

Similar studies will be made on the Underground Cables.

David [copy illegible], Manager, Cable Bureau.

attach
dw.mjk

CC: Mr. R. W. Gillette.

[fol. 6658]

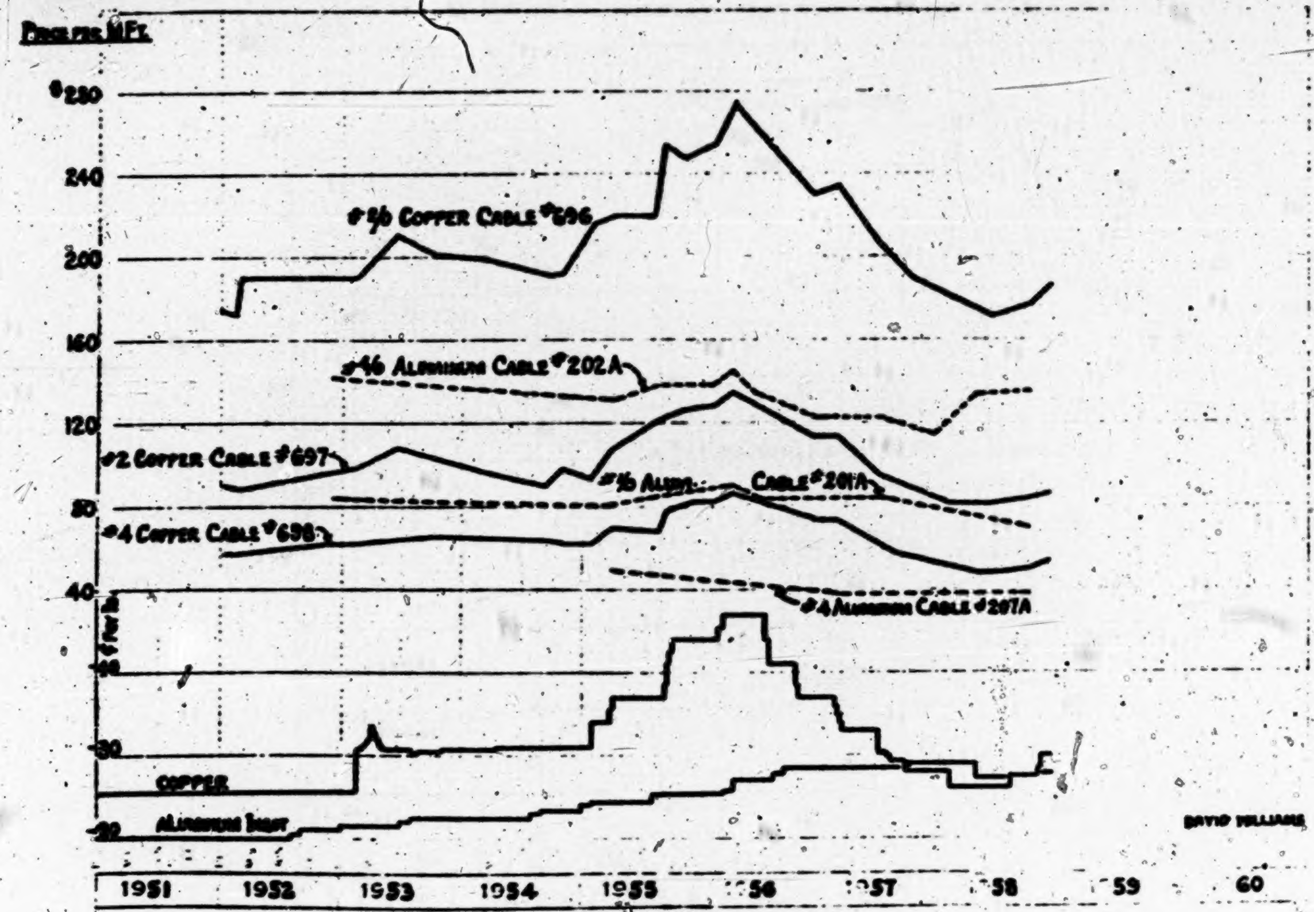
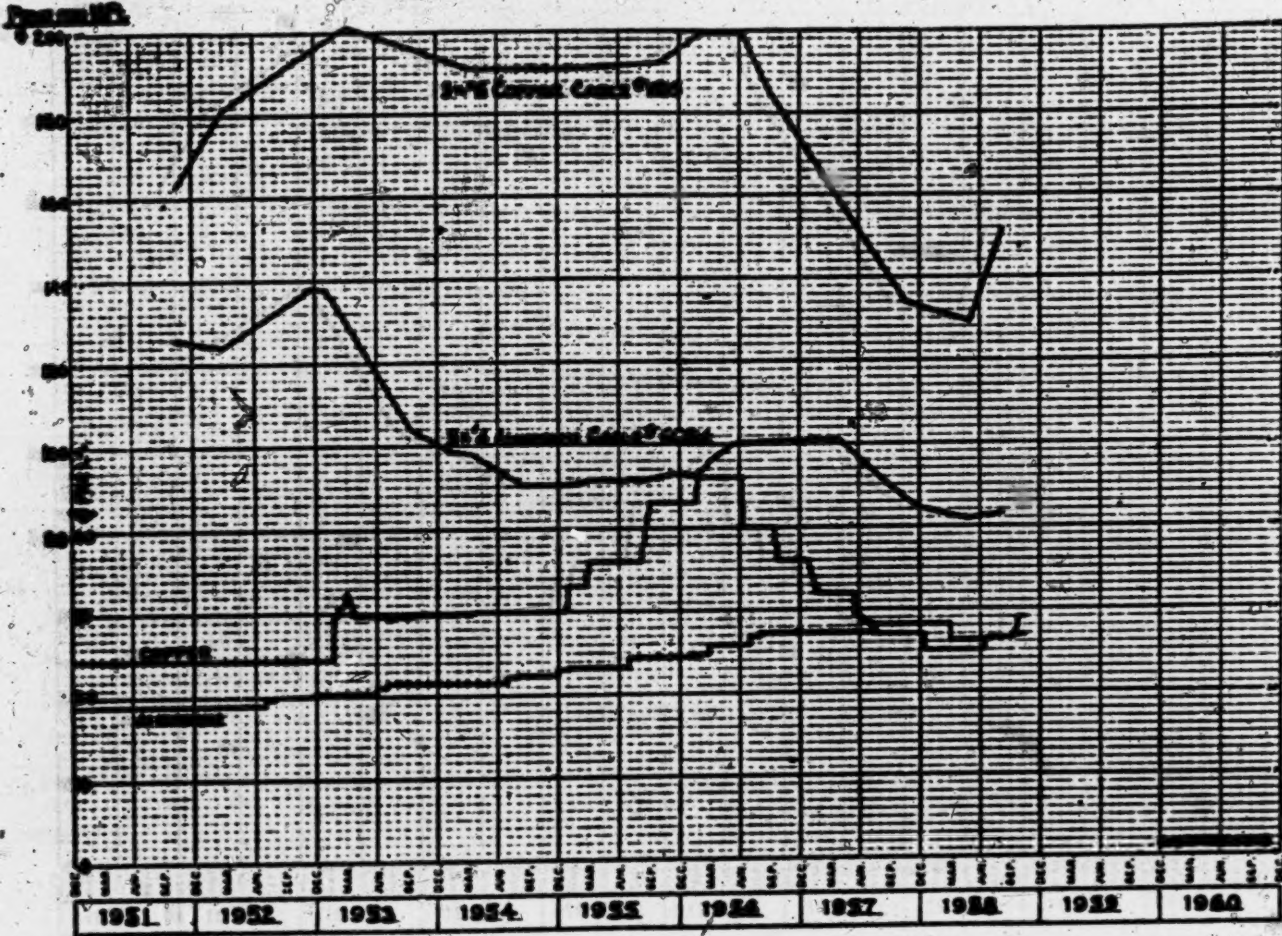


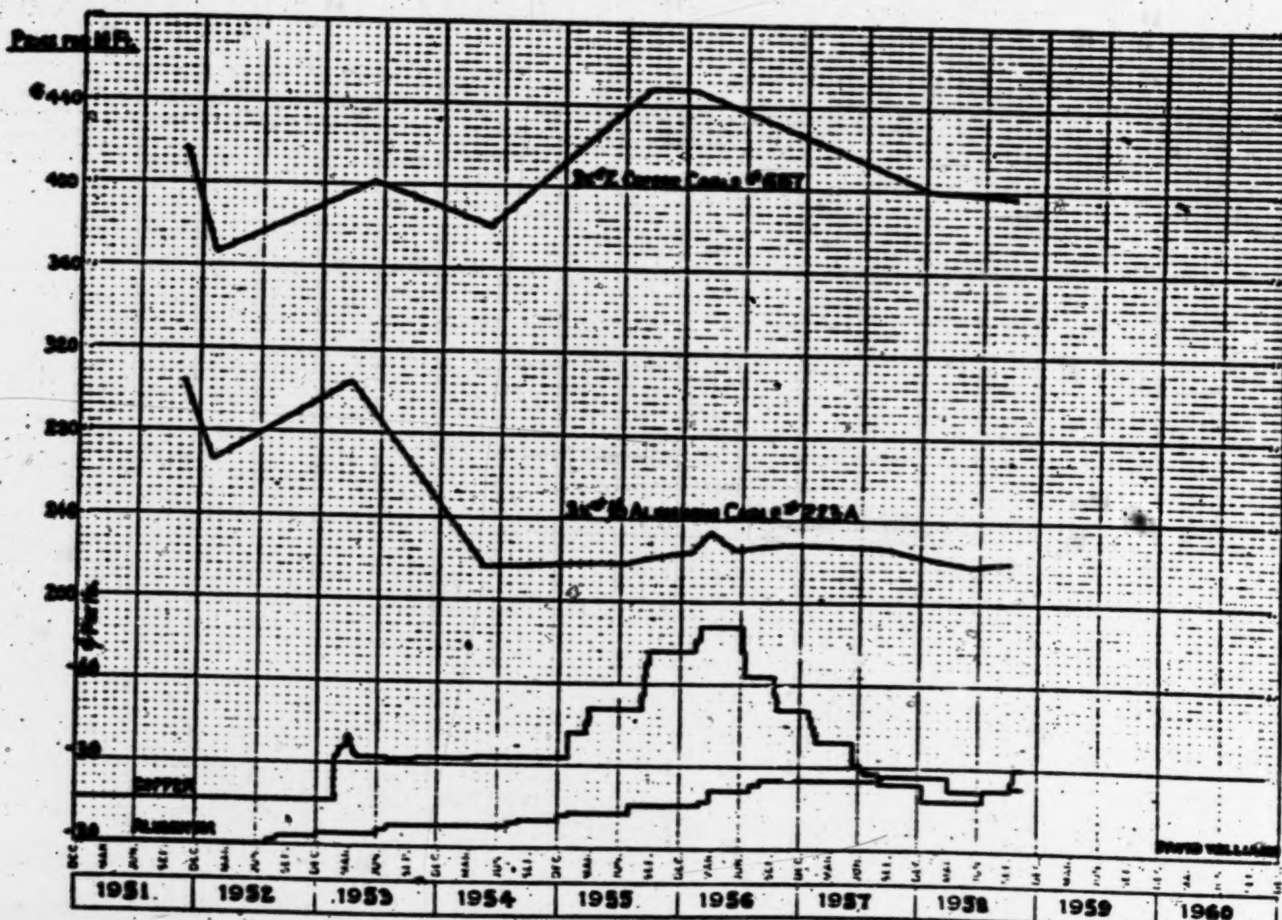
CHART I - WEATHERPROOF WIRE

[fol. 6659]



3498

[fol. 6660]


440
400
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320
240
1951.
1952
1953
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1959
1960

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

DATA SHEET

No.
DATE 10-15-58.
LOCATION

PREPARED BY

SUBJECT

	COPPER					ALUMINUM			
PRIMARY OPEN WIRE	SIZE	SPEC	DES.	Price per 1000 ft	USAGE %	SIZE	SPEC	DES	PRICE
BARE									
	2/0	763	Bare	154.78	90	4/0	216A	Bare	76.66
	2	762	Bare	72.66	5	1/0	215A	ACSR	48.35
	4	761	Bare	45.68	5	4	214 A	ACSR	20.99
COVERED									
	2/0	696	WP	177.37	90	4/0	202A	WP	135.39
	2	697	WP		5	1/0	201A	ACSR	70.40
	4	698	WP	51.05	5	4	207A	ACSR	38.70
SECONDARY OPEN WIRE									
COVERED									
	2/0	696	WP	177.37	90	4/0	202 A	WP	135.39
	2	697	WP	84.00	10	1/0	201A	ACSR	70.40
SERVICE DROP									
	3C 6	685M	Poly	151.80	60	3C 4	689A	Poly.	83.00
	3C 2	687	Poly	378.00	40	3C 1/0	223A	Poly	220.00
UNDERGROUND									
MAINS									
	8L 4/0	629-1	RN	2275.50 ~~2272.50~~	95	3-350 3-500 4/0	208A 690A	Poly RN	2367.00
	1L 2/0	606 M	RN	210.00	5				
SERVICES									
	1#6	604M	RN	43.00	60	1#4		RN	61.00
	1#2	605M	RN	101.00	40	1#1/0		RN	115.00

9-2 (PAD) 150M 7-56 OUTSIDE PL. CONST

[fol. 6662]

CONSOLIDATED EDISON
ALUMINUM VS COPPER CABLE PRICES PER M FT.

DATE	PRICE PER LB. CU.	AL.	(a) BARE CABLES COPPER			ALUMINUM			(b) WEATHERPROOF CABLES COPPER			ALUMINUM			(c) SERVICE DROP CABLES COPPER		ALUMINUM	
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11-13-51	[illegible]	19	-	-	-	-	-	-	-	-	-	-	-	-	$162.95	$417.00	[illegible]	[illegible]
1-4-52	"	"	-	-	-	-	-	-	57.61	$89.39	$173.72	-	-	-	-	-	-	-
2-11-52	"	"	-	-	-	-	-	-	57.07	88.53	171.04	-	-	-	181.00	366.50	174.25	287.00
[illegible]	"	"	-	-	-	-	-	-	57.45	89.13	-	-	-	-	-	-	-	-
[illegible]	"	20	-	-	-	-	-	-	-	-	150.00	-	-	-	-	-	-	-
11-18-52	"	"	-	-	-	-	-	-	61.94	96.80	188.78	-	$84.29	$141.36	-	-	138.00	-
2-2-53	"	20½	-	-	-	-	-	-	62.78	97.58	190.16	-	83.19	-	-	-	137.80	-
[illegible]	[illegible]	"	-	-	-	-	-	-	-	108.63	211.05	-	-	-	201.40	402.50	133.45	304.00
10-13-53	[illegible]	21½	-	-	-	-	-	-	65.53	103.82	201.39	-	-	-	-	-	104.00	-
[illegible]	29-3/4	"	-	-	-	-	-	-	-	95.68	190.78	-	-	-	-	-	98.45	-
[illegible]	30	"	-	-	-	-	-	-	-	-	-	-	-	-	191.00	380.00	98.00	214.45
[illegible]	"	22.1	-	-	-	-	-	-	64.48	90.46	191.42	-	-	-	-	-	90.56	215.95
10-26-54	"	"	-	$75.00	$140.00	-	$41.00	$66.00	63.17	98.38	192.93	-	-	-	-	-	90.50	216.95
2-1-55	33	23.2	-	-	-	-	-	-	61.83	94.30	216.13	-	-	-	-	-	90.50	-
[illegible]	36	"	-	-	-	-	-	-	69.98	107.74	220.11	$49.59	81.60	131.10	-	-	91.67	217.79
7-19-55	"	"	-	-	-	-	-	-	68.72	-	-	-	-	-	-	-	91.00	217.79
8-25-55	43	24.4	-	-	-	-	-	-	78.58	121.63	244.36	-	85.50	137.75	-	447.01	91.00	221.40
11-2-55	"	"	-	-	-	-	-	-	82.29	126.07	247.78	-	-	-	192.00	-	92.17	222.40
[illegible]	"	"	-	-	-	-	-	-	81.97	128.25	253.47	-	-	138.00	-	447.00	92.17	224.00
[illegible]	46	25.9	-	-	-	-	-	-	86.59	135.42	275.43	-	90.00	145.00	[illegible]	-	93.86	[illegible]
[illegible]	"	"	-	-	-	-	51.98	81.62	-	-	251.98	-	83.00	134.00	-	-	100.00	225.00
10-10-56	40	27.1	-	-	-	$22.15	-	80.63	-	-	-	-	-	-	184.00	-	-	-
11-7-56	36	"	$37.64	93.76	193.79	20.89	40.35	76.66	-	-	-	-	-	-	-	-	-	228.00
[illegible]	"	"	-	-	-	-	-	-	74.48	113.00	230.74	-	-	122.70	-	-	-	-
2-13-57	"	"	-	-	-	-	-	-	73.10	112.92	234.60	38.70	-	122.35	175.00	-	-	228.00
4-30-57	32	"	-	-	-	-	-	-	-	-	-	-	-	-	180.00	-	101.19	228.00
6-26-57	29½	"	40.62	78.19	166.04	20.89	40.35	76.66	58.55	95.62	206.86	38.70	84.00	122.35	-	-	-	-
[illegible]	27	28.1	-	-	-	-	-	-	-	-	189.52	-	-	124.70	-	-	90.00	225.90
11-20-57	"	"	-	-	-	-	-	-	-	-	-	-	-	114.40	134.00	-	85.00	224.50
1-23-58	25	"	-	-	-	-	-	-	-	82.13	180.91	-	-	-	-	-	-	-
4-17-58	"	26.1	-	-	-	-	-	-	48.59	81.33	171.30	-	-	134.00	-	400.00	82.00	218.50
8-4-58	26½	26.8	45.68	78.66	154.78	20.89	40.35	76.66	50.60	-	-	-	-	-	151.00	378.00	83.00	220.00
9-18-58	"	"	-	-	-	-	-	-	51.05	84.00	177.37	38.70	70.40	135.30	-	-	-	-
11-13-58	29	"	-	-	-	-	-	-	53.75	86.77	185.92	-	-	-	-	-	-	-

R.Williams
11-20-58

[fol. 6663] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 77

Ebasco Services, Incorporated

Engineers—Constructors—Business Consultants

Two Rector Street

New York 6, N. Y.

Cable Address "Ebascoe"

April 3, 1958.

Mr. R. V. Davies, Vice President
Aluminum Company of America
1501 Alcoa Building
Pittsburgh 19, Pennsylvania

Dear Mr. Davies:

It was a pleasure to talk with you on the telephone today about how Ebasco could be of service to Alcoa in its insulated cable and wire program. I appreciate your confidence in asking us to proceed with the first preliminary step.

As we discussed, the first step would be to prepare a list of companies in the insulated cable and wire manufacturing field from published and other available sources. Pertinent data would be compiled on each, including size, sales volume, products, earnings record, capitalization, stock ownership, markets served, location and size of plants, affiliations or connection with other companies, banking connections and the like. From this preliminary data a number of companies will be selected by consultation with you as being most suitable for further study and more complete data will be obtained on these companies.

Billings for our services shall be at applicable per diem rates (which are based on a normal work day of 7½ hours) in effect for the classification of personnel engaged on your work applied to the actual time such personnel are specifically so engaged. We shall be reimbursed at cost for "out-of-pocket" expenses, including traveling and living expenses, telegraph and telephone toil charges and similar items.

The work will be the responsibility of our Corporate Finance Department which is headed by F. W. Ohles. We should have most of the data assembled in about three weeks' time and either I or Mr. Ohles will contact you toward the end of April and arrange to get together for discussion of the data and our conclusions.

I appreciate this opportunity of again being of service to you, and with best personal regards,

Very truly yours, F. C. Gardner, President.

FCG:ah

[fol. 6664] In United States District Court

Defendants' Exhibit 78

June 16, 1958.

Memorandum from
Corporate Finance Department
To: H. Richter
From: W. C. Huebner
Subject: Re: Cable Companies Study

In line with our discussion of June 13, the following areas are of interest to us for as many of the companies (already given to you) as you have the information.

A Product Line

1 Diversity
2 Quality
3 Prices and pricing policy

B Technical and Manufacturing

1 Manufacturing know-how
2 Engineering and technical reputation
3 Quality control of product

C Company Performance

1 Accuracy of bids
2 Delivery performance

3 Complaints and servicing
4 General standing and regard

D Plant

1 Condition of facilities (maintenance, housecleaning)
2 Modernity
3 Location with respect to materials and customers

E Management (personal comment by individuals and position)

1 Quality
2 Depth
3 Age and general health
4 Experience
5 Sales organization (aggressive, technically competent)

WCH:ah

cc—R. E. Pierce, R. B. Chase, H. L. Lowe, F. W. Ohles.

[fol. 6665] IN UNITED STATES DISTRICT COURT

DEFENDANTS' EXHIBIT 81

Long Island Lighting Co.

ALUMINUM WIRE

YEAR	ALCOA	ROME	ANACONDA	KAISER	GENERAL	REYNOLDS	CIRCLE	ESSEX	SOUTHERN	PD	TOTAL
1957	$382,272 (36%)	— —	$430,083 (41%)	$74,446 (7%)	$45,173 (4%)	— —	$6,173 —	$38,852 (4%)	40,259 (4%)	$39,183 (4%)	$1,057,441
1958	43,800 (20%)	45,990 (21%)	101,550 (46%)	— —	24,975 (11%)	— —	4,200 (2%)	— —	— —	— —	221,163
1959	$15,693 (7%)	$22,546 (10%)	81,984 (35%)	58,770 (25%)	— —	3797 (1%)	50,810 (22%)	1,483 —	— —	— —	235,008
TOTAL 1957, 58 & 59	$441,765 (29%)	$68,536 (4½%)	$613,617 (40%)	$133,216 (9%)	$70,148 (4½%)	$3,797 —	$56,183 (4%)	40,335 (3%)	$40,259 (3%)	$39,183 (3%)	$1,513,612
1960	Rome/Alcoa $46,899 (10%)		$85,886 (19%)	$67,414 (15%)	38,815 (8%)	$7,050 (2%)	$44,767 (10%)	$132,705 (29%)	$30,193 (7%)	— —	$452,754
1961	$69,511 (8%)		$17,608 (2%)	571,591 (62%)	$121,117 (13%)	$78,357 (8%)	— —	$1,463 —	Olin $64,044 (7%)	$745 —	$924,436
TOTAL 1960/61	$116,410 (9%)		$103,494 (7%)	638,025 (46%)	$159,932 (12%)	$85,407 (6%)	$44,767 (3%)	134,168 (10%)	$94,237 (7%)	$745 —	$1,378,190

IN 1956 ORDERS WERE PLACED FOR TRANSMISSION CONDUCTORS WITH ANACONDA ($322,078) AND ALCOA ($120,081). DETAILED RECORDS ARE NOT IMMEDIATELY AVAILABLE FOR 1956 BUT IT WOULD APPEAR THAT ROME DID NOT PARTICIPATE IN ANY ALUMINUM BUSINESS IN THAT YEAR. ANACONDA, ALCOA, GENERAL, KAISER & SOUTHERN SHARED IN DISTRIBUTION CONDUCTORS.

* ACTUALLY PLACED AFTER MERGER

[fol. 6666] In United States District Court

Defendants' Exhibit 82

Public Utilities Purchasing Covered or Insulated Overlap Aluminum Conductor from Both Alcoa and Rome in 1958

	Rome ($)	Alcoa ($)
California Pacific Utilities Co. San Francisco, Calif.	13,174	3,148
Central Hudson Gas & Elec. Co. Poughkeepsie, N. Y.	11,364	34,927
Central Illinois Public Service Co. Springfield, Ill.	9,619	10,294
Cleveland Elec. Illuminating Co. Cleveland, Ohio	911	1,787
Dayton Power & Light Co. Dayton, Ohio	8,574	18,455
Illinois Power Co. Decatur, Ill.	755	5,021
Long Island Lighting Co. Hicksville, L. I., N. Y.	37,844	37,590
New York State Elec. & Gas Co. Binghamton, N. Y.	43,072	198,576
Niagara Mohawk Power Corp. Syracuse, N. Y.	146,542	151,194
Public Service Elec. & Gas Co. Newark N. J.	35,499	1,330
Rochester Gas & Elec. Co. Rochester, N. Y.	19,651	83,722
Virginia Electric Power Co. Richmond, Va.	9,502	566
West Penn Power Co. Greensburg, Pa.	6,464	14,107

Source: Defendants' Answers to Plaintiff's Interrogatories 10 and 11.

[fol. 6667] SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1963

No. 204

UNITED STATES, Appellant,

vs.

ALUMINUM COMPANY OF AMERICA, et al.

ORDER NOTING PROBABLE JURISDICTION—October 14, 1963

Appeal from the United States District Court for the Northern District of New York.

The statement of jurisdiction in this case having been submitted and considered by the Court, probable jurisdiction is noted.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1963 718810 822